WATER CONTROL IN TOKUGAWA JAPAN:

IRRIGATION ORGANIZATION IN A JAPANESE RIVER BASIN,

1600 - 1870

by

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PREFACE

Nine years ago, a number of social scientists came together to present and discuss their work on "irrigation's impact on society." In the published proceedings, the two conveners summarized the conclusions of the group as follows:

> There seems to be a feeling that it is time to return to the data, do detailed studies of individual irrigation systems, work out the technical details of engineering, and assess how the system relates to the natural and social environments. (Downing & Gibson 1974:x)

This I took as my charge for a case study of historical and contemporary patterns of irrigation in a Japanese river basin that I began in 1975 as research for my dissertation. I was first attracted to a study of Japanese irrigation by the central role of irrigated rice cultivation in the country's agriculture for almost two thousand years, the depth of historical documentation, the quality of Japanese scholarship on rural Japan, and the paucity of information on Japanese irrigation in the Western language literature (with several exceptions: Eyre 1955, Beardsley et al. 1959, Befu 1962, Shimpo 1976, Waters 1981). As an anthropologist concerned broadly with agricultural development and sociocultural change, I have intended the study as a detailed historical and ethnographic account of the way people in one river basin setting have organized, over time, to use a resource critical to their political economy. As a specialist on Japan, I am interested here in the sociocultural construction of the countryside and in how water control and use has defined patterns of local cooperation and contention and lines of articulation between peasant and elite in rural Tokugawa society.

This volume represents a substantial revision of my doctoral dissertation (Kelly 1980) and deals with irrigation in the Aka River basin of present-day Yamagata Prefecture during the Tokugawa centuries, 1600-1870.[1] The dissertation was based on fieldwork and archive/library research conducted in Japan for twenty months in 1975-77, including fifteen months in the Aka River basin, and on an additional twelve months in the US in further study of the collected documentary materials (see

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[1] Although the Meiji state replaced the shogunate on the national level in 1868, local administration in Shōnai was not formally abolished until 1870; thus the period of 1600-1870 is used to bound this study.

Kelly 1978, 1980:xvi-xviii for details on research methods). A future work will treat irrigation and agricultural development in the basin in the modern period.

It is necessary to insert at the outset a note of explanation and caution concerning the materials and sources available for basin irrigation in the Tokugawa period. I suspect this evidence and my use of it would not meet the strictest cannons of the historian's craft. Surviving documentary evidence is slim for many aspects of Tokugawa period irrigation, and my account is frankly conjectural at a number of points. The analysis remains tentative. Nonetheless, my attempt to trace Aka River irrigation through time is prompted by a compelling need for longitudinal studies of irrigation organization. I am guided here by Thorkild Jacobsen's dictum to fellow historians of the ancient Mesopotamian state faced with critical gaps in available records: that we "must of a necessity relax the stringent claim of 'what the evidence obliges us to believe' and substitute for it a modest 'what the evidence makes it reasonable for us to believe'" (quoted in Fried 1978:35).

This evidence has been drawn from unpublished documents of the period, published histories, and other secondary sources. I was able to locate in area archives and households a number of relevant primary documents which are listed in section a of the bibliography. For the most part, though, I have relied on a number of published histories--of the prefecture, of the Shōnai area, of towns and villages in the basin, of the river itself, and of the three largest twentieth century irrigation cooperatives. These are products of an unusually active circle of local historians who have diligently combed the Shōnai area for any surviving records of possible historical value. Many of these documents are now preserved at the historical archives section of the city library in Tsuruoka, at several town education committee offices, and in the archives of area Land Improvement Districts (the irrigation cooperatives). The published histories have been of particular value for the rather lengthy and often complete citation of many of these records, including petitions and written testimony of individuals and villages, notebooks of village headmen, agreements among villages, and domain directives, accounts, and memoranda. My present account can no doubt be modified by future archival work on yet unpublished records, but the local histories have proven invaluable sources of a wide range of primary materials.

I have also used a number of more focused studies by historians and social scientists of the political economy of Shōnai Domain to supplement these local histories; more interpretive in nature, they can only be used with caution because they often have places in complex and arcane debates within their disciplines. In addition, technical studies by scientists and engineers of universities and government agencies have proved essential for data on climate, river hydrology, the physical facilities of irrigation and other such topics. Fieldwork and interviews were conducted in Japanese, and all translations are my own.

My research in Japan was generously supported by dissertation fellowships from Resources for the Future, Inc. (1975-76) and from the Japan Foundation (1976-77). Data collection, document reproduction and transcription, mapping, and other research activities were significantly improved by a supplemental grant from the National Science Foundation (#SOC 75-17280). The Behavioral Sciences Publication Fund at Yale University provided financial assistance in preparing this manuscript. The statements and conclusions of this and other of my publications are of course my own and are not necessarily shared by the above institutions.

I have enjoyed the constant support and assistance of numerous persons while in Japan. I would like to express particular appreciation to Dr. Iinuma Jirō of Kyoto University, my initial research sponsor, who has been unfailing in his personal encouragement of the project; to Dr. Higashiyama Isamu and his colleagues at the Faculty of Agriculture of Yamagata University in Tsuruoka, who are always enormously generous of their time and knowledge; to the Watanabe and Narisawa families in the village of Watamae, who shared their homes with me for a year and a half and whose friendship is a continuing source of pleasure; and to the people of Watamae and the surrounding villages, who suffer with kindness and good humor my intrusions and unceasing questions. Watamae will always be my Japanese furusato.

Many others have provided invaluable assistance in the research, including Dr. Shimura Hiroyasu of Tokyo University, who introduced me to Shōnai and whose work on the Aka River has been a constant stimulus to me; Maeta Teruhiko, who tutored me with great patience in the reading of historical documents; Abe Norichika and the other staff of the Nakagawa Land Improvement District, who have permitted me access to archival materials and have allowed me to attend meetings and to follow about ditch-tenders and other staff; and ex-Mayor Katō Yasurō, the town council, and the people of the town office of Fujishima, who have supplied many materials and answered even more questions.

Robert C. Hunt, Robert A. Manners, and Robert J. Smith read the orignal dissertation, and their encouragement and criticisms have been warmly appreciated. I am grateful to Janet Gertz for her work in computer entry of the text.

Japanese terms have been written in the Hepburn romanization, with the modifications used by the Journal of Japanese Studies (see volume 1, page 217). Japanese characters for technical terms and phrases and for uncommon words appear in a glossary. All maps appear together following the last chapter. Japanese personal names are written with the surname first. All Japanese dates have been converted to their Gregorian calendar equivalents. All units of area and length have been converted to metric values with the single exception of the standard volumetric measure of rice in the Tokugawa period, the koku (= 4.96 bushels).

Chapter Id

INTRODUCTION

The Aka River drops from the mountains to the south of Shōnai Plain in northeastern Japan and runs northward across the flat, coastal plain to the Sea of Japan (see Maps 1, 2, and 3). Until recent centuries, Shōnai Plain was a poorly drained marshland, with only scattered settlements on its perimeter and on natural levees of river courses through the otherwise undeveloped expanse of brush and reed vegetation. The Aka River, running off the alluvial fan it had built up where it met the plain, shifted freely among the several channels it had traced across the center of the plain.

Then, in 1605-6, a local domain official organized an embankment and diversion project that stabilized the course of the Aka River; immediately following this, cultivators started construction of several main canals on both sides of the river. Using the river as source, these canals began on the upper alluvial fan, and long sections were modifications of former river channels. Branch canals were dug from these main canals, and by 1750, a total of ten elaborated, gravity-flow, dendritic canal networks covered the plain on both sides of the Aka River. Basin agriculture was almost exclusively rice cultivation, and these networks delivered and drained water for the rapidly expanding paddy lands. Paddy lands irrigated with Aka River water increased from about 5000 hectares in 1650 to approximately 8000 hectares by 1750. There was a much smaller increase to 9600 hectares by 1870. This acreage embraced about 250 administrative villages with about 7500 cultivating households.

It was also in 1600 that several centuries of political instability at the national and local levels were ended by Tokugawa Ieyasu, who was able to establish a national hegemony that lasted, with varying degrees of vigor, until 1868. The shogunate which Ieyasu fashioned retained direct authority over about one-third of the country; the remainder was apportioned as regional domain-fiefs to over 250 vassal lords. Shōnai Plain and the surrounding mountains composed one such domain of the Tokugawa agrarian state. From 1624 to 1868, Shōnai Domain was held by a single line of domain lords, the Sakai. Like many other domains, the economic base of Shōnai Domain was irrigated-rice agriculture, and the rice-monocropped Aka River basin, containing about one-third of the arable acreage of the domain, was central to the economic fortunes of the domain

lord, to the livelihood of the thousands of peasant cultivators, and to the new wealth of landholding, tenanting merchants.

It is the pattern of irrigation in the Aka River basin that is the subject of this monograph. As a case study, it is both a description of how the various tasks of basin irrigation were handled during the Tokugawa centuries and an analysis of the relative participation and authority among the domain officials, peasant cultivators, and large landholders who came to be involved in exploiting and using basin water resources. As such, the study raises the issue of who controlled the resource most critical to the agricultural base of this regional domain. To what extent, it asks, did the domain attempt to control water as it so attempted to control the other factors of rice production--land (e.g., through cadastres and land transfer prohibitions) and labor (e.g., through population movement restrictions and institutionalization of a status hierarchy)? By the second half of the period, a second elite of towne merchants and wealthy cultivators was accumulating large holdings of paddy lands; did it intervene in irrigation affairs and to what degree did irrigation become an arena of conflict between rival elites? And, to what extent were the peasant cultivators themselves, with heavy rice tax burdens and a household economy almost entirely dependent on rice cultivation, able to develop local and autonomous irrigation organization in the basin?

We will see that in fact there was neither effective elite control nor strong local autonomy in Aka River irrigation. Domain officials tried to avoid exercising authority in irrigation matters, peasant cultivators remained rather unorganized as water users, and large landholders showed remarkable non-intervention. All came to fill some irrigation roles but no distinctive pattern of control resulted from their participation. Aka River irrigation remained decentralized, with performance of irrigation tasks fragmented among officials, peasant cultivators, and large landholders.

It is remarkable that such a decentralized pattern continued throughout the Tokugawa centuries, and the monograph inquires into the reasons for this in hopes of shedding light on the determinants of irrigation organization--a central problem in the anthropological study of irrigation--and on the nature of state-peasant relations in the later Tokugawa state system--an important problem in Tokugawa studies. From the beginnings of the river-canal networks in the early 1600s, certain characteristics of basin topography, climate, and stream flow made water supply difficult and unpredictable; this was aggravated by the highly elastic water demand of japonica rice cultivation. Still, through the mid-seventeenth century, it appears that water demand was safely below available water supply. Evidence suggests, however, that by about 1750, water demand had increased as a result of substantial expansion of paddy land acreage to the point where supply was tight and there were shortages in the critical summer months. Furthermore, canal networks had elaborated

to the degree that accretion and overlapping were severely complicating water measurement and allocation. Not surprisingly, then, it was in the mid-1750s that petitions and records of conflicts and dislocations began to appear.

I initially expected that at this point a shift towards either autonomous water user organization or elite control would have emerged to cope with these shortages and to improve irrigation efficiency. That is, I expected to find, in the second half of the period (1750-1870), technical improvements of the physical facilities and/or clarification and elaboration of irrigation procedures and roles as a result of either (a) domain officials or large landholders taking a more active, interventionist role in basin irrigation or (b) peasant cultivators mobilizing into a more effective and structured organization. Remarkably, there is little evidence that either occurred, despite a supply-demand balance that remained tight for the rest of the domain period. Shortages and conflicts continued, but there was neither water anarchy nor a breakdown of irrigation in the basin--merely a continued low level of water efficiency.

In this light, the decentralized and dispersed irrigation organization of extensive, interconnected physical networks serving 9600 hectares in over 250 basin villages assumes a heightened significance. In spite of water shortages and dislocations, why was there no shift toward a centralization of irrigation task performance after the 1700s? This is the particular problem to be explored. What we will find is that there were several factors of political administration and land tenure that operated to discourage both elite control and autonomous water user organization. Domain officials were disinclined to intervene actively because of the administrative practice of delegating self-regulation to local groupings and because of a lack of financial incentive; in promoting paddy land expansion, the domain had allowed much basin acreage to slip from its tax base. The dispersion of holdings among several service areas, customary limits on rents to tenants, and the highly favorable land tenure arrangements they enjoyed discouraged the intervention of large landholders. And the effective associations of peasants were undermined by the weakening of the administrative village as an organizational locus due to a growing incongruence of village residency and the locations of lands cultivated and registered holdings.

There are several necessary preliminaries to a description of patterns of Aka River irrigation. In the next section, I will briefly explain the analytic framework developed for this case and its place in the anthropological study of irrigation and irrigation organization. A following section will locate irrigation and water control among the significant issues in understanding the political economy of Tokugawa Japan. The chapter will close with a short sketch of the river project and initial canal construction in the early 1600s that formed the basis for Tokugawa canal networks and paddy land development.

The anthropological study of irrigation

Irrigation is the controlled application of water to agricultural land and crops. Its complexity to users and its interest to social scientists derive from the multiple connotations of the adjective 'controlled.' Politically, it connotes the distribution of control over water resources among the state, other elites, cultivators, and non-agricultural users. Economically, it refers to the degree of control over water as a factor of production. Socially, it suggests that patterns of water control may imply broader patterns of cooperation and conflict among the cultivator-users. And technologically, it implies the degree and nature of technical control over available water resources. Of course, among settings and over time, there will be variation in the scarcity (or superabundancy) of water; in the difficulty with which it may be exploited and used; and in the degree to which it is critical for agricultural and/or other purposes. But where water is scarce or superabundant, difficult to exploit, and critical in one or several uses, water control in its multiple connotations will warrant a careful investigation by those who seek to understand the society in which it is found. Japan, for nearly two thousand years, has been such a society.

Anthropologists first became interested in irrigation for its possible causal role in the origin of the state. Julian Steward, in his explorations of the dynamics of the early civilizations of the Old and New Worlds, noted among their common characteristics an intensive, irrigated cereal cultivation. On that basis he formulated a cross-cultural type, "irrigation society," as part of his theory of "multi-linear evolution" (Steward 1955a). It was he, too, who introduced into anthropology the ideas of Karl Wittfogel through the influential 1953 American Anthropological Association symposium on "irrigation civilizations" (Steward 1955b). As implied by the subtitle of his synthetic work, Oriental Despotism: A Comparative Study of Total Power (1957), Wittfogel's foremost concern has been with a cross-cultural political condition--what he saw to be a virulent and harsh form of despotism. It was in seeking to explain this form of despotism that he traced its origins to a particular "hydraulic setting." He was especially interested in the division of labor required by "hydraulic agriculture" and in the consequent rise of a highly centralized, bureaucratic elite, whose control over labor coordination, conflict resolution, and waterworks administration provide a base for generalized "total power."

Since the early 1950s, the debate on the role of irrigation in state origins has become quite ramified and sophisticated (see Adams 1966, Price 1971, Cohen 1978, Redman 1978:220-37), but it has no direct bearing on this, a case study of irrigation in an existing state. Nor is Wittfogel's hydraulic hypothesis of any analytic utility. He himself specifically excluded Japan from the oriental despotic states; in his rather contorted typology, he relegated it to the "submarginal zone of the hydraulic world" (1957:195). His reason was topographical:

> The peculiarities of the country's water supply neither necessitated nor favored substantial government-directed works. Innumerable mountain ranges compartmentalized the great Far Eastern islands; and their broken relief encouraged a fragmented (hydroagricultural) rather than the coordinated (hydraulic) pattern of irrigation farming and flood control... Japan's irrigation agriculture was managed by local rather than by regional or national leaders; and hydraulic trends were conspicuous only on a local scale and during the first phase of the country's documented history.(1957:197)

More importantly, there are fundamental problems with the structure of his argument that render it inapplicable to empirical investigations--an ambiguous concept of centralization, an undefined concept of scale, a shifting of levels between macro-social and micro-social, and an assignment of causal priority to topography and aridity.[2]

Of more immediate relevance to the Aka River case has been the 'second generation' of research stimulated by this early work--the case studies (e.g., Gray 1963, Fernea 1970, Glick 1970), comparative studies (e.g., Millon 1962, Kappel 1974, Hunt & Hunt 1976), and theoretical critiques (e.g., Adams 1966, Price 1971)--that have appeared in the last twenty years as interest has broadened to embrace historical and contemporary irrigation in pre-state and existing state settings. This growing body of research is demonstrating a wide range in the complexity and organization of societies in which irrigation is practiced and much variation in the manner with which these societies have handled water control problems. However, as I have discussed elsewhere (Kelly 1982b), there are recurring conceptual and methodological ambiguitites in this literature. In particular, I have identified four issues that require clarification; these are worth reviewing briefly here as this study is intended to illustrate a more useful specification of irrigation concepts.

First, in describing the way people organize to manage water resources for agricultural uses, there is a tendency to focus exclusively on water delivery canals and the roles associated with them (e.g., Glick 1970, VanderMeer 1968). In fact, exploiting water for crop growth is often a much more extensive problem. At least potentially, there are four separate phases: the control of a water source, the delivery of water, application to crops, and drainage. Of course, the importance and elaboration of each in a given setting will depend on crop needs and cultivation practices. It will also vary with the technical and organizational level of the irrigators. In all cases, though, one must determine empirically the extent of irrigation facilities and roles in all four phases. The Aka River case will prove to be an appropriate

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[2] For further discussion of Wittfogel's hydraulic hypothesis, see Mitchell 1973, Hunt & Hunt 1974:129-31, Steward 1978.

illustration of this because all four phases of water control were both necessary and problematical. Chapter four will explore how the Aka River itself was controlled and managed both as water source and trunk drainage outlet for the basin paddy lands. Chapters five and six will focus on delivery, use, and drainage within the two largest of the eleven canal networks spreading through the basin. Hence, 'irrigation' and 'irrigation and drainage' are throughout used as shorthand terms for a multi-phase process of water management.

It is from irrigation broadly conceived in this way that I have proposed a formulation of 'irrigation organization' (Kelly 1982b). Briefly, one may observe that in each phase of water control and use there are certain tasks which are performed. These may be expressed in four categories: the landscape must be modified and facilities constructed; they must be maintained and operated; water must be allocated among users; and conflicts must in some way be resolved. Again the importance amd elaboration of these tasks will vary considerably with the setting, but that too is a matter for empirical determination. Analytically, though, I argue that our descriptions of the social organization of irrigation must be based on the performance of these four types of tasks in the four phases of irrigation:

	facility construction	operation/ maintenance	water allocation	conflict resolution
source control				
water delivery				
in-field use				
drainage				

Such task performance can be described in terms of roles, behavior, and norms. That is, one can identify the roles with rights and duties to perform these tasks--such as, in the Aka River case, the rural magistrates, district deputies, intake guards, canal guards, corvee laborers, etc. One can detail the actual practices of irrigation with descriptions of turntaking along a branch canal, repair of a diversion weir, conflict resolution cases, etc. And, one can explicate the normative principles which inform task performance--the body of rules, laws, and customary procedures by which irrigation tasks should be performed. To be sure, the concept of role and the relations of roles, behavior, and norms are disputatious issues of central importance in social theory. In my own work, I use 'role' to refer to named social positions with identifiable rights and duties and I treat role behavior and normative expectations as complementary though seldom congruent features of role descriptions. 'Irrigation organization' is thus the

configuration of roles which perform the above four types of tasks in the four phases of irrigation,dand it is a primary object of this study to describe Aka River irrigation organization in these terms.

One term I shall avoid using in my characterization of Aka River irrigation is 'irrigation system.' It is true that the frequency with which studies in the literature do refer to this would recommend 'irrigation system' as one of our master analytic concepts; VanderMeer's definition is representative:

> An irrigation system is an arrangement by which water is conveyed from a source to an area needing water to facilitate the production of desired crops. As such a system involves four elements: (1) one or more sources of water; (2) fields; (3) physical structures such as canals and ditches which can carry water from its source to the fields; and (4) a functioning set of principles and techniques adopted by humans to create a water-flow pattern within the physical structures related to the amount of water available from the source, the characteristics and locations of the physical structures, and the varying needs of the fields. (VanderMeer 1968:720-721)

The difficulty with such a postulated "system" of hydrology, topography, engineering, and management is that it introduces an unwarranted isomorphism of what are three analytically distinct and, more often than not, empirically incongruent "systems": natural water flow patterns, physical facilities, and irrigation role configurations. Thus, I shall differentiate the hydrological, technical, and social levels of irrigation with the respective concepts of drainage basin, physical network, and irrigation organization.

To describe natural water flow in a landscape, I find most useful the geomorphologists' concept of the drainage basin--"the area which contributes to a particular channel or set of channels...the 'source area' of the precipitation eventually provided to the stream channel by various paths" (Leopold et al. 1964:131; see also Chorley 1969:78). The drainage basin of the Aka River was initially selected because it exemplified alluvial fan topography with extensive, dendritic canal networks (two features common in northeastern Japan) and because its paddy lands were central to the fortunes of a regional domain state (and thus its irrigation organization potentially attractive to state elite). I began my analysis by determining how the physical facilities and environmental modifications of source control, delivery, use, and drainage were distributed over the natural water flow of the basin and how the facilities were linked to one another. It was soon apparent that within the basin during the Tokugawa period, there were actually four water sources supplying four generally discrete service areas of paddy lands: the master stream, the Aka River itself; two tributary streams to its east and west; and a small pond network constructed on the western fringe of

the basin to capture and store water from hill-side run-off (see chapter 3). Because paddy lands irrigated by the master stream constituted about 85% of the total basin arable acreage, I chose to focus on that portion of the basin. In so far as they shared a common source and drainage outlet, I consider these paddy lands to have been the center of a loosely integrated physical network of irrigation. This included, conceptually, the headwaters forest, upstream and downstream riverworks, and the delivery and drainage canals that carried master stream water.[3] The picture of Aka River irrigation this study presents was then derived from an inspection of task performance in each of the four phases of master stream irrigation. As we will see, however, some of the roles in master stream irrigation had rights and duties in other physical networks as well. Thus, just as the drainage basin (hydrological unit) and the physical network of master stream-related facilities (technical unit) were not isomorphic, neither were the physical network and the configuration of irrigation roles (social unit).

In addition to the tendency to focus on delivery canals and an unhelpful notion of 'irrigation system,' the irrigation literature also suffers from an ambiguous use of the term, 'centralization.' A persisting issue in irrigation studies has been the relationship of irrigation to state authority and political power, and many of these studies tend toward one of two polar positions. Some see a propensity for elite control of irrigation; water control is regarded as an important locus of political action and a dimension of elite control (e.g., Hunt & Hunt 1974, 1976). Other investigators have emphasized the frequency of local autonomy in irrigation management, the tendency of cultivator-water users to generate procedures and form associations for operating water works (e.g., Glick 1970; Geertz 1959, 1973, 1980; Maass & Anderson 1978:336). This dichotomy is usually described in terms of 'centralization': 'decentralized' local autonomy or 'centralized' elite control. In these terms, the Aka River case would seem to be anomalous because there was for the duration of the Tokugawa period neither elite control nor local autonomy.

Such a dichotomy, however, fails to make an important distinction between the internal configuration of authority among roles performing irrigation tasks and the external relationship or connection of these irrigation roles to those in other social systems, most notably the general political system (the state). These are, I would insist, independently variable features of irrigation organization. Elite and/or water users may participate in a centralized or decentralized configuration of irrigation roles. This is a separate question from whether this irrigation organization is effectively articulated to the

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[3] Actually, 'network' will be used in two contexts. In addition to the concept of physical network here described, I will also refer to the 'canal networks'--the eleven networks of branching delivery-drainage canals that had separate intakes along the Aka River master stream.

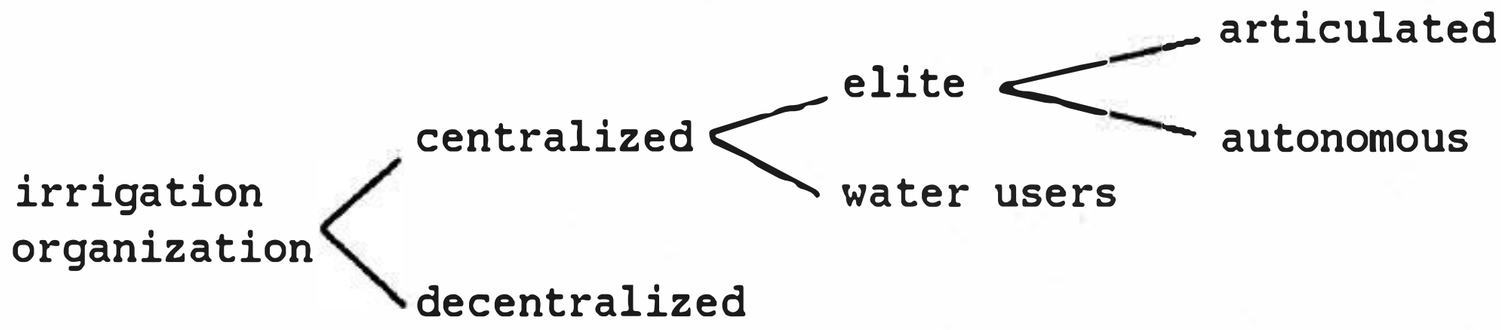
state. Thus, I use centralization/decentralization as a variable of internal irrigation organization; it refers to the degree to which irrigation roles are hierarchically configured and authority in irrigation task performance is concentrated. Articulation/autonomy, by distinction, is the dimension of variation referring to the degree to which irrigation organization is articulated to or autonomous of the state.

A judgment about the relative authority among irrigation roles in a setting suggests an initial, broad division into decentralized and centralized organization. In the former, there is a fragmentation of authority functionally and areally among many roles and a minimal body of regulations and customary procedure; there is no cumulation of authority into a pervasive pattern of control. With centralized irrigation organization, there is a concentration of authority through a nesting areal and functional hierarchy of irrigation roles, with explicit, codified procedures.

However, irrigation organization may be centralized in one of two senses--by strong water user organization or through elite control. By the former, I mean that water users themselves mobilize and maintain an effective and independent organizational framework and generate a body of self-regulating procedures. Elite control is a pattern by which a political, economic, or social elite assumes those irrigation roles decisive enough to control irrigators and irrigation. The elite may themselves be irrigators (e.g., Hunt & Hunt 1974) or they may be 'outsiders' (e.g., Fernea 1970).

Finally, although by definition self-regulating water user organization is autonomous of general political authority, where irrigation is elite controlled, the elite may be articulated to state authority by virtue of exercising formal or informal political rolese Or it may be autonomous, independent of, and possibly competitive with state authority.

Taken together, such distinctions yield four potential 'states' of irrigation organization: decentralization; autonomous, local water user organization; control by an elite articulated to state authority; and control by an elite independent of state authority. The latter three are thus forms of centralized irrigation:



Of course, as ideal types, these distinctions offer only a first-order framework to guide one's assessment of a particular situation, which will most likely fall somewhere between these states. It is in fact the

shifting tensions among local water users, among elites, and between water users and elites that should be at the center of our investigations. In analyzing irrigation organization in a setting, we need to identify the ethnographic referents of water users, state-articulated elite, and autonomous elite and then judge their relative participation and authority in irrigation task performance. From this we can determine if and where concentrations of authority develop and what their consequences are for control of irrigation in its several phases. Finally, we can move to the central explanatory problem of irrigation organization, which is to discover the factors which give rise to one or another organizational form and to shifts from one form towards another.

This formulation provides the framework of analysis used in this study. We will see that in these terms the configuration of irrigation roles in the Aka River basin remained decentralized throughout the Tokugawa period. Basin irrigation brought together warrior-stratum officials of the regional domain, peasant-stratum village officers and cultivator-water users, and a small elite of large landholders who accumulated tenanted holdings in the downstream plain from the mid-1700s on. Despite several reasons for expecting either a form of elite control or strong water user organization (or at least a sharp struggle for control), no decisive concentration of authority emerged among the irrigation roles. The domain officials' stance remained passive and circumspect, the involvement of the large landholders was quite limited, and there was no appreciable organization of peasant water users. This is not to argue that among the tasks of irrigation performed by domain officials, peasant water users, and large landholders, there was no differential authority or that there were not linkages between certain irrigation tasks and general political authority. But it is to argue that there was no systematic and decisive concentration of authority that might be identified as water user autonomy or elite control as the terms have been discussed here.

It is in seeking to explain this persisting decentralized configuration of irrigation roles that I came against a fourth difficulty in the irrigation literature--the frequent tendency to posit certain 'natural factsd of water or a certain 'scale' of physical facilities as operating directly and mechanically to determine the form of irrigation organization (see Kelly 1982b for further discussion of this point). That is, many investigators (e.g., Maass & Anderson 1978:2, Leach 1961:9, Netting 1974:33, Spooner 1974, Bennett 1976:399) trace a simple and direct connection between certain 'facts' of water--shortages, stochasticity, unpredictability--or 'large scale' facilities and a centralized irrigation organization often articulated to the state.

By this reasoning, there should have been a shift towards elite control or strong water user organization in the Aka River basin after the mid-1700s. There was not, and I will argue that the reasons can be found in features of the sociocultural context of irrigation, the domain political economy. To be sure, cultivator/irrigator behavior is always

limited, as Leach (1961:9) puts it, "by such crude nursery facts as that water evaporates and flows downhill"; but however self-evident such "facts" may appear, their meaning and significance--their status as "facts"--derive from a cultural frame and a social matrix. The Aka River case demonstrates this. The broad constraints of aridity and gravity are insufficient to explain usefully the variety of organizational forms irrigation may assume. It is only by treating irrigation in its socio-cultural context that we can hope to understand how and why it assumes these forms. This case study shows how, in one setting, 'facts' of hydrology and engineering are given meaning by cultural distinctions and given form through social action.

The significance of irrigation in Tokugawa Japan

The Tokugawa state apparatus was forged by Tokugawa Ieyasu, who emerged in 1600 with control over the whole country after several centuries of weak central authority and strong but unstable regional warrior powers. It was composed of a central shogunate and several hundred semi-autonomous regional domains. Although often described as "centralized feudalism," it was more accurately a durable but shifting amalgam of centripetal and centrifugal forces. It was replaced in 1868 with a new central authority which adopted explicit goals of political modernization, social reform, and industrialization.

I would describe this Tokugawa political system of a national shogunate and regional domains as an agrarian state. I use this term in a way similar to Lenski's (1966:189-295) "agrarian society," Greenwood's (1974) "peasant state," and Bendix's (1978) "traditional state." It is a state whose political economy was divided essentially into a small, privileged, ruling elite which expropriated the surplus production of a vast majority of non-privileged peasant cultivators. This elite rule was usually legitimated ideologically as a natural hierarchy of status differentiation. Bendix (1978) has characterized this societal type (a) by the linkage of superordinate rights to agricultural produce (the locus of wealth), privileged social status, and the exercise of political authority and (b) by the need of the sovereign, who ruled with divine sanction, to supplement personal command by delegating authority. Given these two characteristics, any study of the agrarian state must consider the management of elite claims on agricultural production and producers and the competition among elites for wealth, status, and authority. Where the production base of the state was irrigated agriculture and where water was a problematical factor of production, it becomes critical to ask to what extent and under what conditions water control was an important element of state-peasant articulation and/or an arena of elite competition. This is the significance of irrigation in Tokugawa Japan.

The importance of water control and of irrigation organization in Tokugawa Japan has of course long been recognized by both Japanese and Western scholars. Yet irrigation has usually been examined in the context of village studies, in which it is typically assessed for its functional contribution to the village as a community. The axiom most frequently expressed (though differentially evaluated) in Marxist, non-Marxist, and, most recently, populist (minshūshi) Tokugawa village studies is that land was held individually by competing households while water was controlled communally by the solidary village. That is, the village is viewed as a closed, self-sufficient, and corporate unit, drawing its power over member households from its administrative responsibilities delegated by higher authorities (assessment and collection of taxes, etc.); from its role in bounding important social, ritual, and ceremonial activities; and from communal control over certain key resources (water, grasslands, and forest). Analysts who disagree at other points are in general agreement here:

> Each village was an autonomous administrative and economic unit, represented by its headman and managed by a village council. The internal economy of the village was practically self-supporting. Thus, the village represented a fairly closed political, economic, and social unit. (Nakane 1967:46)

> Since the economic life of the village depends on irrigation, the function of the mura has great significance both as the residential and also in many cases as the water-controlling unit.(ibid.:43)

> In Japanese villages land was already individually owned, and the individual farming of individual holdings was already the predominant form, even in the Tokugawa period. However, it was extremely rare for an individual family's holding to be in the form of a consolidated block of land. It was generally split up into many parcels scattered over a wide area. Moreover, the irrigation system was not sufficiently developed to provide separate channels to each parcel of land and it was common for many fields to be irrigated by water which flowed off the field of another owner. Consequently, an individual farmer was in no position to flood his own fields freely whenever he wanted to. And irrigation control by the community consequently had to be strict. (Fukutake 1967:83; see also ibid.:81-87, Smith 1959, Beardsley 1964, Johnson 1963:220, Yoneyama 1967:341)

Village water control is believed to have derived from aspects of water delivery to the fields and from allocation among parcels. Smith emphasizes the former:

> ...(T)here was need in nearly every village for an extensive system of ditches, dams, dikes, ponds, tunnels, and water gates.

> Since these could be constructed and maintained only by community effort, their use was subject to community control. (1959:209)

Nakane and Fukutake assert the latter. A household received its water by the position of its parcels within the field grid; the volume and exact timing of water availability depended on village-generated rules and was administered by village roles.

> ...(T)here is no great difference between a larger landowner and a small one, or a tenant. Both owner and tenant remain on the same level as cultivators, and aligned according to the order of the water flow... Further, the decisive factor in this system is the manner in which water is allocated. Even though a cultivator may own a large amount of land, the water, without which cultivation is impossible, is out of his control. Therefore, as Ōishi emphasizes, whether one is an owner-cultivator or tenant-cultivator, farming management is completely subject to the control of the water flow; that is, to village control. (Nakane 1967:75-6)

Such a village perspective on irrigation can be quite limiting and even seriously distorted. General claims of village "communal" control of water use are distorting when used as fuel for the highly polemical "village community" debate (the sonraku kyōdōtai ron). This is a long-standing, diffuse debate in Japanese scholarship (and politics) revolving around the idealization of the rural settlement as a kyōdōtai or "community" (the German Dorfgemeide is sometimes used). It has taken place in a highly charged atmosphere of larger issues that are cultural (the impact of Westernization), economic (the necessity for industrialization), and political (the persistence of "feudalism" and the possibilities for democracy). That the countryside was composed of such "communities" is largely accepted; the deep divisions surround the meaning of "community" and how it is to be evaluated. Marxist-influenced scholars evaluate it very negatively; the kyōdōtai was a pattern of feudal control which had to be overthrown and eradicated to reach the stage of capitalist society. The village community was seen in a much more favorable light by Yanagita Kunio and other folklorists, a view that is again receiving much attention in Japanese scholarly circles now that it has been resurrected by the advocates of "people's history" (minshūshi; see Gluck 1978:36-7). Irokawa Daikichi among others stresses the horizontal ties of the "natural village" community as the potential for collective and positive action (see the English translation, Irokawa 1975, but also Irokawa 1970 for a more measured analysis).

Even when it avoids the polemics of the "village community" debate (e.g. Nakamura 1977), a village perspective can prove limiting because most cultivators and most paddy lands in Tokugawa Japan were actually part of multi-village, multi-level networks of irrigation and drainage. The

structures of water roles and rules represented an important supra-village, regional level of organization. Hall (1974), Bolitho (1974), and others have drawn our attention to the contradictory centripetal and centrifugal tendencies in the Tokugawa political order, to the inherent tension between measures to consolidate and concentrate authority and the preference for a delegated and cellular mode of administration. Irrigation in many parts of the countryside was ad significant interface between shogunate and domain officials, peasant cultivators, and, where it emerged, the rural elite of tenanting large landholders. To understand fully the political and economic significance of irrigation, it is necessary to focus on the networks themselves and to trace out in them the roles and procedures of water source control, delivery, in-field use, and drainage that constituted the social organization of irrigation.[4] This is what the present study seeks to do for the Aka River basin area.

One must quickly add that there was considerable regional variation that demands further study before any broad generalizations about Tokugawa irrigation can be properly formed. There were several thousands of irrigation networks in Tokugawa Japan. Some, like the Jūnikagō network in the Takahashi River basin (Fujii & Kahara 1976) and the Nikaryō network in the Tama River basin (Waters 1981), had highly codified procedures and strong autonomous water user organizations. Other networks, suchdas that of Shiozawa in the Shinshū mountain basin of Kitasaku (Hatate 1970:123-153) were under the rather tight, hereditary control of wealthy, resident gonō households. And there were networks, for example in the middle Tone River basin on Kantō Plain, in which shogunate officials closely supervised source control, delivery, and drainage tasks (Kikuchi 1966:70-71). Finally, there were networks such as the case at hand, operated by dispersed and decentralized configurations of roles.

The beginnings of the Aka River canal networks

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[4] There are of course a number of Japanese scholars whose irrigation work avoids an exclusive focus on the village including Tamaki Akira, Hatate Isao, Furushima Toshio, Horiuchi Yoshitaka, and, foremost, Kitamura Toshio (see Kelly 1982a). Kitamura's case studies, most of which have been collected together (Kitamura 1973a), remain the starting point for this Japanese irrigation resarch. Even his cases, however, seldom provide a comprehensive picture of a network or basin because he was usually drawn to what he saw to be the special or distinctive aspects of a particular local setting. On the other hand, his general conclusions (Kitamura 1973b) present more of a composite of Tokugawa irrigation than an explanation of the variations of basin and network technology and organization

The first inhabitants in the Shōnai area were hunting and gathering groups in small temporary settlements in the hills surrounding a partially submerged plain. There was no contact with the Yayoi culture core in the south. Then, from 700 AD to 900 AD, the area came under the military subjugation of the imperial court at Nara. The first agricultural settlements on the plain were stockades, around which rice cultivation was introduced by peasants brought in by the state. This initial direct state control waned after 900, and Shōnai came to reflect the common pattern of weak central authority, private estate expansion, and increasingly powerful local proprietary lords and warriors. Between 900-1600, Shōnai passed through phases of warfare and peace, local autonomy and outside control, unified administration of the plain and fragmentation (see Kelly 1980:101-113 for details). Throughout these centuries, however, settlements remained scattered and restricted to the perimeter of the plain and to high land such as natural levees. Rivers like the Aka River were unstable and uncontrolled, and supplemental water for the rice grown in the wet backswamps of villages was drawn from naturally ponded water and by short channels from streams. Irrigation matters were probably handled within single settlements.

By the late 1500s, Shōnai found itself between two major regional lords, Uesugi in Echigo and Mogami in the Yamagata basin; in the 1580s, the plain was a battlefield for the two forces. Uesugi emerged victorious in 1588, but after joining the forces against Tokugawa Ieyasu, he lost most of his lands in 1600. Control of Shōnai was given to Mogami, whose stature rose considerably to that of a major daimyo lord, with fief lands officially assessed at 520,000 koku.[5]

The largely unexploited land and water resources of Shōnai Plain must have appeared attractive to Mogami. He immediately placed senior retainers at the existing fortified settlements of Sakata (along the coast at the most promising port site), Ōyama (in the coastal dunes on the western edge of the Aka River basin), and at Fujishima (on the plain within the Aka River basin), and he granted them the lands around these settlements as fiefs. For Fujishima, he chose Niizeki Inaba-no-kami Kushō and awarded him 7000 koku in lands. When he inspected his new Shōnai lands in 1601, Mogami was sufficiently impressed with the strategic location of the old fortified settlement of Daihōji, in the middle of the Aka River basin a few kilometers from Fujishima, that he selected it as the location for his "retirement castle" (inkyo shiro). The castle to be built at Daihōji was renamed Tsuru-ga-oka (later, Tsuruoka), and Niizeki was ordered to double as the castle deputy for Tsuruoka. He was given a

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[5] Of which Shōnai composed 141,874.458 koku. This official assessment was derived from the cadastre carried out by Uesugi in 1590-91, under orders from Hideyoshi. The distribution of this total across the plain confirms that most settlement was on the higher ground on the perimeter of the plain.

force of 100-150 cavalry and 200 foot soldiers and moved from Fujishima to the Tsuruoka settlement which had a population at the time estimated at no more than 4000 persons (OA 1974:175). Mogami returned to his home base in the Yamagata basin.

The initial problem facing Inaba was the river, which at that time ran from Kumaide (where it entered the plain) in a northwesterly course before turning north to flow through Daihōji itself. Flood discharges had eroded the Daihōji fortification walls in the past, forcing abandonment of the settlement, so Inaba's first concern was to provide a modicum of protection for the new construction.

There are no surviving accounts of Inaba's project, and references in two nineteenth century histories are brief (the passages appear in OA 1974:172). Apparently he had a short revetment built along the west bank of the river at Kumaide, using boulders and timbers to redirect the flow into a more northerly channel, roughly similar to its present-day course. Although the term "cut-off" (shimari-kiru) was used, this was most certainly not a complete diversion but rather a regulation of small volumes into the existing channel with the maindflow redirected into the new channel.

It is interesting to note that by 1600, rather sophisticated river training and revetment techniques had been developed in other Japanese basins of similar topographies (see Aki 1972:481-509, Tamaki & Hatate 1974:176-211). If applied along the Aka river, they would have significantly increased the degree of control over the river, but judging from such projects elsewhere, they would also have required specially skilled engineers and a much higher level of investment in labor and materials. Aka River control, though initiated by domain elite and modestly supported with its resources, represented a minimal investment--and returned a minimal protection, to judge from the record of periodic flooding.

Inaba's embankment project, done in 1605-6, had important implications for agricultural expansion as well as castle defense; in a more central channel off the alluvial fan, the river was at once more accessible to east bank cultivators and less threatening to west bank cultivators. Indeed, the project was followed by a decade of canal construction, which in turn led to a century of paddy land development throughout the basin. Of the three largest main canals, work on Shōryūjigawa and Inaba seems to have begun around 1607. In 1615 or so, work commenced on the third, Nakagawaa

Underlying the three projects was a common pattern of local initiative and resources sanctioned by, or at least encouraged by, domain officials. The Shōryūjigawa Main Canal was apparently initiated by the Kudō household, headman of a village near Tsuruoka, with approval from Niizeki; the project was directed in collaboration withdvillage leaders along the

prospective channel line. Cultivator support could be mobilized because all villages were surrounded by undeveloped areas into which they could expand with the new delivery-drainage flow. Stratification within villages and sizeable land holdings by some households may have lent a degree of compulsion to labor mobilization. In the case of Inaba Main Canal, it was Niizeki as fief holder rather than as domain official who encouraged canal construction to relieve water shortages in the area of his fief holdings.[6] The origins of the Nakagawa Main Canal are less clear, but several Shōnai historians agree it was dug around 1615 through the collaboration of a district deputy under Niizeki and local peasant leaders (Maeta Teruhiko, personal communication).

These three major main canals came to serve over 85% of the paddy lands irrigated with Aka River water, but there were also eight other small main canals with intakes along the river (see Table 1). They served areas ranging from about 40 hectares to just over 500 hectares in 2 to perhaps 12 villages; most were at the small end of this range. Tenpō and Etchū Main Canals had intakes along the Bonji River in the master stream headwaters, but all of the other intakes were in the alluvial fan section like the large three. Little, unfortunately, is known of their origins or later organization (see Kelly 1980: 128-31).

Like the Kumaide embankment work, none of these main canal projects was as technically demanding or as technologically sophisticated as canal projects elsewhere in Mogamiės domain and in other parts of northeast Japan. Except for the two later short canals from the headwaters (Tenpō and Etchū), all were essentially modifications of old river courses off the alluvial fan across the plain. Labor was recruited from existing villages in the potential main canal service areas; cultivators' tools and straw mats and baskets would have sufficed for earth-moving. Except for Inaba, completion of which was delayed by political events, both Shōryūjigawa and Nakagawa and the other smaller main canals that were also dug from the river were completed at once in their entire lengths, rather than progressively extended. This was to allow return drainage to the river; it was the branch canals dug from the main canals that were subsequently elaborated as land was brought into rice cultivation.

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[6] Unlike Shōryūjigawa and Nakagawa, though, the Inaba Main Canal was unfinished when Mogami lost control of Shōnai in 1622 and his officials withdrew. The project was not renewed until 1689, apparently through the initiative of two prominent cultivator households. It was completed in 1692 (see Kelly 1980:125-127). I will not deal in detail with Inaba in this study, but a recent work by a local historian, Naganuma Gensaku, supports the contention that its organizational features were quite similar to the other two major canal networkse(Naganuma 1978:1-76).

Table 1

Main canals along the Aka River master stream in the Tokugawa period

main canal		period of construction	est. acreage served (1870)	intake position	number on Map 3
Tenpō	天保	1831-38	50 ha	right bank	1
Etchū	越中	1703-14	40 ha	right bank	2
Kumaide	熊出	1661?	40 ha	left bank	3
Sankason	三ヶ村	unknown	40 ha	left bank	4
Shōryūjigawa	青龍寺川	c. 1609	4100 haa	left bank	5
Ōgawa	大川	1706	260 ha	right bank	6
Shida	志田	c. 1610?	510 ha	left bank	7
Inaba	因幡	1607-22; 1689-92	1150 ha	right bank	8
Gokamura	五ヶ村	unknown	200 ha	left bank	9
Nakagawa	中川	c. 1615	3000 ha	right bank	10
Daihōji	大宝寺	unknown	40 haa	left bank	11

Notes: Main canals are listed in order of intake position, from upstream to downstream. The acreage figures for 1870 are estimates calculated from domain cadastral surveys and from the 1875-76 Land Tax Reform survey registers. Total service area acreage in 1870 is estimated to have been 9430 hectares, of which 8250 hectares (87%) were within the three largest canal networks-- Shōryūjigawa, Nakagawa, and Inaba.

In sum, then, there was little irrigation and rice cultivation on the plain prior to the opening of the 1600s, when what became main canals of extensive branching networks were dug as modifications of old river courses. Construction was simple and locally organized, with domain elite sanction but little direct control and only minor investment. The impetus was not new technology, available elsewhere but not evident here. Rather, it was changed political circumstances, the imposition of an administered peace, although I believe the explanation to lie more with the 'administration' than with the 'peace.' That is, it may be tempting to see this flurry of local initiative as encouraged by the prospect of continued peace after such prolonged turmoil; indeed, from hindsight we can see 1600 as the beginning of two and a half centuries of peace throughout Japan and as the moment when a new central authority emerged after several centuries of virtually no strong political center. But in 1600, to Tokugawa Ieyasu, to the regional lords, and to the local village leaders, the future of the new central and regional arrangements must have seemed hardly assured. Perhaps more compelling to those cultivator-leaders like Kamon who coordinated and promoted the canal construction were such measures as the cadastres of Uesugi (in 1590) and then Mogami (in 1611-12), which tightened controls and raised domain claims on local production, and the lords' halting but increasingly successful efforts to demilitarize the countryside and drive a wedge between warrior and cultivator. Such trends, more than the prospects of peace, may have convinced those who returned to or remained in the villages that agricultural expansion was a necessary, viable and preferred response to the threat of a more effective regional power.

Mogami's attempts to consolidate his administration in Shōnai, however, were suspended several years after the cadastre by political events. In 1614, Mogami Yoshiaki died, and his death touched off a succession struggle that extended even to lesser retainers. The troubles provedd intolerable to the shogunate, and in 1622, the Mogami family was removed by Tokugawa Iemitsu for its inability to rule properly, and its lands divided. The 138,000 koku Shōnai fief was given to Sakai Tadakatsu, who was moved from a smaller domain in Shinshū (Matsushiro). His arrival in Tsuruoka in 1622 marked the end of 21 years of Mogami rule and the beginning of 250 years of Sakai rule in Shōnai and the Aka River basin.

Chapter II

SHŌNAI DOMAIN

Shōnai Domain was but a small regional unit in the larger Tokugawa state. "Centralized feudalism" is a term often used to describe this state, but more accurately it was a peculiar mix of feudal and bureaucratic structures, held together in a tenuous balance of central control and regional autonomy. The shogun exercised direct authority over about one-third of the country as his personal holdings (including most of the major cities and precious metal mines as well as lands assessed at over six million koku). He had only indirect control of the rest of the country, principally divided into over 250 territorial domains and granted to domain lords personally subordinate and responsible to the shogun. As Hall has observed, ties of personal subordination shaded into bureaucratic relations at the lower levels of administration:

> The force of authority which united the system was at the top feudal, particularly as it applied to the relationship between Shogun and daimyo. Yet within the administrative subparts, within the direct jurisdictions of the Shogun or daimyo, authority was increasingly exerted through bureaucratic means. (Hall 1970:165)

If relations within the state administration ranged from feudalistic to bureaucratic, there was also a continuous tension between centralizing and decentralizing forces. Initially, in the first century of Tokugawa administration, the political center exerted strong controls over the regional domains. The power of the shogun to give and take away lands was perhaps the most potent of his powers over the domain lords, and in the seventeenth century, it was used frequently to reward and punish. Control over the domain lords was also maintained through a country-wide system of inspector-spies, restrictions on castle contruction in the domains, commercial monopolies, forced contributions to shogunate public works projects, the requirement that all domain lords alternate residence in their home castles with regular attendance at Edo, and other measures.

Yet, by the mid-1700s, the Japanese state was once again sliding back into the condition of weakening central authority and growing regional autonomy as, one by one, shogunate perogatives were lost to the domain lords. To Bolitho (1974), this movement toward decentralization in the

Tokugawa state owed much to the behavior of the fudai daimyo, the "house domain lords." As the original vassals of the Tokugawa family, they were the most closely bound to its fortunes. After Ieyasu came to power, they were frequently positioned between the territories of the tozama daimyo, the "outside domain lords," whose loyalties were questionable. Bolitho has argued that the house domain lords increasingly came to see their postion as territorial barons to be the more promising and the more pressing. By the eighteenth century, distinctions between fudai and tozama daimyo blurred as the fudai daimyo came to behave more and more as domain administrators and less and less as loyal Tokugawa vassals. It was the cumulative effect of the shift from vassal to domain lord on an individual level that contributed mightily to tipping the institutional balance from the centralism of the seventeenth century to increasing regional autonomy in the eighteenth and nineteenth centuries.

These matters are raised here because they suggest something of the position of Shōnai Domain within the broader Tokugawa state. Sakai Tadakatsu, whose line continuously controlled Shōnai Domain for eleven generations from 1622 to 1868, was just such a fudai daimyo.[7] Despite the vassalage ties to the shogun, even the fudai daimyo enjoyed considerable independence in the exercise of authority within their domains. While admitting of important influences emanating from the larger political culture (for example, the neo-Confucianist moral philosophy which underlay the division of society into four estates), the above discussion supports the claim that Shōnai Domain may be fairly treated as the political-economic context for Aka River irrigation.

The administrative framework of Shōnai Domain

Like the larger Tokugawa state system, the administrative strategy of the early Sakai lords embodied contradictory centripetal and centrifugal tendencies.[8] On the one hand, they moved decisively to draw into the castle town the warrior retainers, to cut their ties to the land, and to insure that their political and economic fortunes would be bound up with the prosperity of the domain. They were used to staff a comprehensive, hierarchical administration that linked lord and peasant.

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[7] Sakai Tadakatsu headed one of the three lines of the Sakai family, which was one of the monbatsu (pedigreed vassal families), those families from around Mikawa Province which were the earliest Tokugawa vassals in the fifteenth century.

[8] This section is primarily drawn from descriptions of Shōnai Domain administration in OA 1974:244-72, 502-21, Naganuma 1964:407-19, OB 1974:92-100, and Maeta Teruhiko, personal communication.

On the other hand, this tightening of control over warrior and peasant was balanced by a cellular mode of administration, a preference for segmenting the horizontal strata of society into vertical groups which were delegated self-regulating responsibility. These groups were themselves of several levels; the most local were the warriors' group (kumi), the agriculturalists' village (mura), and the townspeoples' ward (machi). This pattern of horizontal status stratum and vertical local group was in distinct contrast to the exercise of authority through a network of personal ties that had characterized the several previous centuries. It was a "rule by status" in Hall's terms: ". . . a new and more bureaucratic system of administration in which authority was exercised impersonally toward legally defined groups and classes rather than through links of paternalistic subordination" (Hall 1974:44). With its hierarchy of officials and its several levels of local groups, the administrative framework of Shōnai Domain reflected this tension between concentration and delegation of authority.

Shōnai Domain was approximately 2000 sq. km. in area and composed roughly the plain, the surrounding mountains, and the coast. For administrative purposes, it was divided into town (murakata) and countryside (jigata). The towns in this sense were Tsuruoka, the castle town, and Sakata, the principal port of the domain at the mouth of the Mogami River. There were four levels of units in the countryside: the gun (county), tōri oregō (district), kumi (village group), and mura (village). The old gun or kōri (county) boundaries were retained but had no administrative significance in the Tokugawa period; the Mogami River served as boundary between Akumi-gun to the north and Tagawa-gun to the south.

Each of the two counties was divided into districts; Akumi-gun was divided into three districts (called gō), while Tagawa-gun, a larger area, was divided into five districts (called by a different term, tōri, for reasons unknown). At the third level, these districts were each subdivided into three to seven village groups (kumi), groupings of roughly contiguous villages. It was the village (mura) which constituted the fourth and lowest level of domain administration; from two to forty-nine villages composed a single village group.

It is necessary to distinguish analytically the domain administrative village (the mura) from the village as a spatial settlement unit and the village as a social community; the latter two are often referred to by residents and analysts alike as the buraku. For the moment, it will suffice to note that the settlement pattern on Shōnai Plain was typically a nucleated cluster of houses surrounded by arable fields and that in the Tokugawa period, the administrative village generally coincided with this nucleated settlement. Thus, the administrative mura usually was isomorphic with the spatial buraku; I will leave for later consideration the extent to which this was also a social community, a buraku in the

social sense.[9]

According to an 1861 map of Shōnai Domain (Tsuruoka City n.d.), there were by that year 747 domain administrative villages organized in 35 village groups, which in turn composed the 8 districts of the 2 counties. While comparison with other records exposes minor inaccuracies with the map (these will be noted for the drainage basin later), it provides useful data on the geography of domain administration. It illustrates, first, that although the eight districts remained fixed in number anddin boundaries through the period, the founding of new villages had led to reorganization of and an increase in the number of village groups. This reorganization does not explain, however, the wide range in number of villages per village group and number of village groups per district; it is unclear why these varied so greatly. The map confirms that the principle of spatial contiguity was generally used to demarcate administrative units. More importantly, though, the map also illustrates the very low degree of correspondence between administrative divisions and either the natural hydrological divisions of the domain or the canal networks of water delivery and drainage.

Finally, the map indicates that there was some land within the boundaries of Shōnai Domain which did not fall under the official jurisdiction of the domain, thus somewhat complicating administrative procedure. In 1632, Sakai Tadakatsu had made a small, 10,000 koku fief grant to a former domain lord, Katō Tadahirō, whom the shogunate had placed under his supervision (the grant included some land in the Nakagawa service area). In 1647, Sakai also made fief grants to two sons; Tadatsune was given 20,000 koku in lands around Matsuyama, north of the Mogami River, and Tadahirō was given 10,000 koku of lands around Ōyama, including some villages in the Shōryūjdgawa Main Canal service area. While the line of Tadatsune continued to control the Matsuyama fief as a "branch domain" little distinguished from the main Shōnai Domain, both Kato Tadahirō and Sakai Tadahirō died without issue. By shogunal law, their fiefs did not revert to the domain but rather to the shogunate. Thus, within the Aka River basin, there were a small number of villages in shogunal territory, but I will argue that in irrigation this was not a significant administrative distinction.[10]

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[9] This pattern contrasted with, for instance, the area around Niiike in western Japan, studied by Beardsley, Hall, and Ward (1959). There, in the Tokugawa period, several named, nucleated settlements (generally termed buraku and translated as "hamlet") constituted a single administrative village; thus Niiike was one of five hamlets which composed the administrative village of Shinjō-kami (Kakizaki 1964).

[10] Actual administration of these shogunal lands alternated throughout the period. At times, a small office of two or three shogunal officials was maintained in the town of Ōyama, responsible to the northeast Japan

Very little demographic research has beenddone for the Shōnai area, and population levels for the domain period can be estimated only in gross terms. Local historians have made several calculations from domain documents, which suggest that towards the end of the eighteenth century the total domain population was in the range of 135,000, with perhaps 19,000 persons resident in the castle town of Tsuruoka and 15,000 in the port of Sakata (see Kelly 1980:156). If we add the approximately 30,000 persons in the shogunate-controlled territory and the Matsuyama branch domain lands, both within the boundaries of the domain, we obtain a total figure of roughly 165,000. By status strata, there were on the order of 127,000 peasants, 25,000 townspeople (artisans and merchants), and 13,000 warriors and their dependents.

It is more difficult to estimate the population within the Aka River drainage basin because surviving documents seldom provide district and/or village breakdowns. Bringing together scattered figures for the number of households in 77 villages of the 142 villages in the Shōryūjigawa and Nakagawa Main Canal service areas yields a mean value of 30.3 households per mura (and a range of 4 to 138 households per mura). This would suggest approximately 2700 cultivator households in Shōryūjigawa and about 1600 cultivator households in Nakagawa. On the basis of relative service area acreages, I would estimate that there were on the order of 7000-7500 cultivator households served by Aka River water in all eleven main canal areas. Without any reliable estimates of persons per household, it is impossible to determine the total population within the service areas.[11]

The warrior stratum in Shōnai was composed of all retainers of the domain lord and was sub-divided into upper rank warriors (termed gokachū) and lower rank warriors (okyūnin). The former, from whose numbers were drawn the senior domain officials, held hereditary fief allotments from the domain lord. The latter, who served as bodyguards, foot soldiers, attendants, and minor officials, received fixed annual stipend allotments. In 1675, upper rank warriors numbered 445. By 1840, their numbers had increased to about 500; this same year, there were 1924 lower rank warriors (OA 1974:510).

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regional shogunate office in Obanazawa. For much of the period, however, administrative responsibilities were delegated to Shōnai Domain (in 1749-50, 1769-1814, 1815-41, 1844-63; see Naganuma 1964:170-1, OB 1974:90-2).

[11] Village numbers are from OB 1974:110, Naganuma 1964:437-42, and YKS 1968:670-5. These and total population figures cited in OA 1974 are all from official domain documents; see YKS 1980:409-431 for a selection. Hanley & Yamamura 1977:38-68 discuss the problems of using such population data.

The enfeoffment of the upper rank warriors was only a nominal land grant (e.g., YKS 1980:57-58). More properly, it was a hereditary grant of certain rights to the produce of a territory of a fixed registered yield; this territory was dispersed among many villages and the produce (rice and some secondary goods) was delivered by the villages to the domain granary. The retainer later received a share equal to his fief value times the official mean tax rate for that year. He exercised no jurisdiction over the territory of the fief grant.

What began as a garrisoned body of warrior vassals developed soon into an elaborated domain administration as civil duties proliferated and peace continued (the network of offices and procedures may also be seen as a way of insuring control and supervision over the retainers). It was from this warrior stratum that the officials of the domain were chosen.d At the top, of course, was the domain lord himself (see Satō 1975 for biographies of the Sakai line). The domain lord had a residence in Edo as well as the castle at Tsuruoka, and OA 1974 estimate that by the nineteenth century, he came to spend about 16-17 months in Edo for every 8-10 months in Tsuruoka.

Under the domain lord were the karō, who formed his senior advisory group, the council of elders responsible for all domain matters. These usually numbered between four and six and were drawn from those upper rank retainers with fiefs of over 1000 koku. That is, while one's status, expressed in terms of fief or stipend, was fixed and hereditary, official positions were filled by appointment. Often, in fact, several persons were appointed to the same position and served in one-month rotationd periods. Assisting the karō and serving as apprentices to the position were several officials known as churō.

Below the council of elders was a panoply of officials composing the administrative structure of the domain. It is not necessary to detail here the entire structure (see OA 1974:244-250 for a more complete listing); rather, we will be concerned with the three positions in the administration with jurisdiction over agricultural and rural matters. These were the domain rural affairs officer (gundai), the rural magistrate (gun-bugyō), and the district deputy (daikan). The post of rural affairs officer was a senior one, directly below the council of elders; it involved both agricultural policy and general domain fiscal policy, based as it was on the appropriation, distribution, and marketing of rice. It was usually filled by 2-3 persons at a time, drawn from retainers above 300 koku.

The rural magistrates, the gun-bugyō, were charged with matters of land ownership, crime and public order outside the towns, public works construction, and the rural populace. Drawn from upper rank retainers above 100 koku, there were four magistrates for the eight districts of the domain--each was assigned two districts.

The third position, the district deputy or daikan, was a post complementary to that of the rural magistrate; the two both reported to the domain rural affairs officer (gundai). The duties of the district deputy included crop inspection, collection of taxes, and promotion of agriculture. There were sixteen district deputies, two for each of the eight districts; like the rural magistrate post, it was filled by upper rank retainers with fiefs above 100 koku. On important matters, the district deputy would collaborate with the rural magistrate in the district--for example, in the compilation of population registers, the replacement of village headmen, and so forth. Attached to all three of these positions were various assistants, who conducted many of the actual inquiries, projects and duties. There were subordinate posts named shitayaku, tedai, and tōri-kakari mentioned in documents of different eras; the distinctions among these posts, if any, are not clear, but they were generally, though not always, filled by persons from the lower warrior ranks.

Below the domain-wide rural affairs officer and the district-level magistrates and district deputies were the village group headmen, the ōjoya; these were the officials placed in general administrative control over each village group within the districts. The ōjoya were in an anomalous position, an interface between the domain warrior stratum administrators above and the purely peasant village officers below. In status they were of the peasant stratum, but for salary purposes, they were treated as lower-rank warrior retainers, drawing a stipend of, typically, 50 koku per year (cf. YKS 1980:62). They were also accorded the privileges of surname, sword, and certain embellishments of front gate and house design. At the same time, they were resident in the local area and served at the convenience of the domain officials above them, all resident in the castle town. Though the post was appointive, it was in fact often hereditary; even so, village headmen were frequently shifted around among different village group assignments and on occasion lost their position entirely. The difference, then, between the lower-rank warrior retainer and the village group headman was that the former received a perpetual and hereditary stipend while the latter's was a stipend attached to the post; if the occupant was removed or if his son did not succeed to the post, he did not continue to receive the stipend.[12]

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[12] This anomalous character is due in part to the beginnings of local domain administration in the area. When Sakai Tadakatsu moved to Shōnai in 1622, he brought with him only a small vassal band. Their numbers were supplemented by rōnin warriors from the disintegrating Mogami Domain. Furthermore, in appointing the initial village group headmen, he selected not from the warrior retainers but rather from among local peasant chiefs and gentry (see OA 1974:270 and Naganuma 1964:411 for examples within the Aka River drainage basin).

Finally, at the lowest rung of the administrative structure were the administrative villages (mura) and their headmen. The administrative village was a device for the extraction of agricultual production and the maintenance of public order in the countryside, and it was a creation of the early cadastres using the existing nucleated settlement pattern. The approximately 750 administrative villages of the domain were at once the terminal units of a hierarchy of domain officials and also the most local cells, the smallest official 'containers' of peasant cultivators. They were the object of concern of higher officials but also the subject of broad delegated authority:

> . . . the village was charged by the regieme with the obligation to service its own needs including internal governance and adjustment of civil disputes. Or, stated in legal (and artificial) terms, this was a profoundly pervasive delegation of authority to the village to get it to attend to its own business. As a matter of jurisdiction, the Tokugawa village was empowered and obligated by the feudal authorities to manage its own internal affairs, in accordance with its customary law with minimum intrusions from the law of the overlord (hatto) so long as the tax was paid.(Henderson 1975:12)

> . . . Rather than cherish the right to adjudicate, the prevailing official attitude at all levels of feudal authority was that civil disputes should be settled by the villagers themselves; they were only officially noticed as a matter of grace, not right.(ibid.:18-9; cf. Befu 1967)

One found in these villages the same status distinctions common in rural Tokugawa Japan: (a) those peasants with registered proprietary rights and tax duties to arable land (honbyakushō); (b) peasants without such rights and duties to arable land but who nonetheless maintained themselves as separate residential households and worked land holdings through various tenancy and sharecropping arrangements (mizunomibyakushō); and (c) agricultural laborers who worked as fieldhands and servants for peasants with land rights (nago) or who did wage labor in the towns. Villages contained peasant households of all three types in proportions varying with ecological and historical circumstances.

There was also some variety in the administrative structure of basin villages. The most important postion was that of village headman, a role charged by the domain with overall responsibility for such matters as collection and delivery of the village tax, preparation of population registers, organization of public works, and communication of directives from higher officials. This position, known as kimoiri in domain villages and nanushi in shogunate villages within the domain, was most often held by a single person, though occasionally in a large village there might be two headmen. In some villages, the headmanship was hereditary; in others,

it was filled in rotation by all or some of the registered cultivator households. In addition to expenses (travel money, writing paper, etc.), the headman received a salary equal to about 1% of the village assessed yield, either taken from the collected tax or subtracted as an exemption on the headman's liable holdings (see Befu 1966 for a general study of the headman role).

In many villages there was a second position known as the soeyaku (or kumigashira in shogunate villages), which was an assistant to the headman. Then there were the otona (or otonabyakushō in shogunate villages), the elders of the village, whose advice and consent was sought by the headman in matters of importance. In some cases, the otona elders seem to have been all of the registered cultivator household heads; in other villages, they were the heads of the leading households--the old peasant chiefs, the first families, the more wealthy registered cultivator households. In either case, some matters were occasionally discussed and decided at a general village assembly (yoriai) of all households.

The role of the village 'container' of peasant cultivators in irrigation affairs will arise frequently in later chapters. Here it will suffice to emphasize that there was a tension between hierarchical control and self-regulation in the administrative structure that related domain lord, warrior-retainer, and peasant cultivator. In the early seventeenth century, many domain lords like Sakai Tadakatsu consolidated control of land and people in their domains by establishing a permanent, impersonal, and bureaucratic hierarchy of officials; administering the countryside was a four-tiered structure of domain rural affairs officer, district deputy and rural magistrate, village group headman, and village headman. At the same time, actual management of affairs was accomplished through considerable delegation of responsibility; consequently the village as the designated local group of peasant cultivators was an important administrative unit (although its effectiveness in particular contexts such as irrigation is a matter for empirical determination). This tension characterized domain administration throughout the period.

Land tenure and taxation in the domain

Primary objectives of domain administration included the protection of agricultural production through social control measures and the extraction for redistribution of the production surplus through taxation measures. It was the genius of the shogunal-domain (bakuhan) state system that, at least initially, it so successfully created a structure that achieved both. As we have seen in the previous section, Sakai Tadakatsu was able to undermine intermediate claims by a landed gentry by removing the warrior retainers from bases in the countryside to the castle town, where they were used to staff a domain administrative hierarchy. He established direct control over production and producers with a comprehensive on-site

survey, assessment, and registration of land and with the collection by officials of a series of taxes based on that registration.

One of Sakai Tadakatsu's first acts was to order a new cadastral survey. This was conducted in 1623-24 and registered 53,000 koku in lands above the existing assessment (YKS 1980:3-23). This 38% increase was due to the discovery of old but unregistered lands, the actual expansion of paddy land acreage following canal construction, and the imposition of stricter, more uniform methods. In the cadastre, the old karidaka method of measuring productivity and acreage by harvested sheaves of rice, which had been used by Mogami in 1611-12, was replaced with the kokudaka method of volumetric measure of threshed and hulled grain. First, the area of each parcel was measured[13] and then classified according to land use. In the countryside three categories of land were taxed: paddy fields, dry-crop fields, and housesites. Certain lands of designated shrines and temples were surveyed but exempted from taxes. Roads, pathse water channels, and channel banks were not registered; in this sense, proprietary rights were not delegated by the domain. Undeveloped land (gen'ya, a valuable source of firewood, grass for compost, earth for construction, and so forth) was not measured but its boundaries were noted; some undeveloped land was reserved for domain use (e.g., castle repair materials, thatch for warrior homes), but usufruct rights to most were alloted to peasant cultivators by village unit.

The measured paddy field and dry-crop field parcels were next graded as to soil quality, water retention capacity, drainage, and other factors into one of four grades (housesites were a single grade). The putative yield of each parcel was then calculated from a standard formula, the kokumori.[14] For example, by this formula, 1 tan of #1 grade paddy land had

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[13] The units of areal measurement were:

1 chō = 10 tan (= 0.992 ha)
1 tane= 10 se
1 se = 30 bu
1 bue= 6 square shaku

These units had long been in use, but their relative values were adjusted first by Hideyoshi and later by Ieyasu. Although not uniform, generally in the fifteenth and sixteenth centuries, 1 tane= 360 bu and 1 bue= 6.3 or 6.5 sq. shaku. Hideyoshi in his cadastre reduced the former to 1 tane= 300 bu, and then Ieyasu reduced the latter to 1 bue= 6 sq. shaku. These adjustments amounted to indirect methods of increasing claims on the land; the tax rate per tan of the kokumori could be held constant while increasing the actual acreage that composed an official tan.

[14] In Shōnai Domain, this kokumori formula was as follows:

#1 grade paddy filed (jō)	= 15
#2 grade paddy field (chū)	= 13

a rated yield of 3 koku of unhulled rice grain (or 1.5 koku of hulled and semi-polished grain); thus, a parcel that was measured to be 1.5 tan in area and was rated as #1 grade would be registered with an official yield (known as bunmai) of 4.5 koku. These surveying and registering standards were applied uniformly throughout the domain, unlike previous cadastres. Land registers were compiled which listed each parcel of land, its classification, measured area, grade, and assessed yield as well as the name of the cultivator.[15]

In addition to its uniformity of application, the cadastre was intended to strengthen lord-peasant ties in two ways. First, the parcel cultivator whose name appeared in the land register was accorded cultivator rights and tax responsibility for that parcel. This had the effect of cancelling existing tenancy arrangements; however, because many large holdings were apparently worked by owners with nago servant-laborers, it did not result in a fully 'independent' peasantry.

Also, it was the cadastre which in effect created the administrative village, the mura. An attempt was made to register to residents of a settlement all arable land surrounding the settlement, even if this meant occasional exchanges of parcels with cultivators in other settlements. Cadastral registers (kenchi-chō) were then compiled by village unit, and the last step of the process was to sum up all of the assessed yields of the parcels within a village unit to obtain a total figure, the village assessed yield (muradaka). It was this figure that became the basis of

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#3 grade paddy field (ge)	= 11
#4 grade paddy field (ge-ge)	= 9
#1 grade dry-crop fielde(jō)	= 10
#2 grade dry-crop field (chū)	= 8
#3 grade dry-crop field (ge)	= 6
#4 grade dry-crop field (ge-ge)	= 4

All housesite land was 10.

These numbers represented the expected yield of 1 tan of that grade of land expressed as a volume of semi-polished rice (so-called 'brown rice,' gogō-suri genmai), which equalled about half the volume of threshed but unhulled grain. Thus, '15è for #1 grade paddy (the top grade) meant that 1 tan of top quality paddy land was expected to produce 1.5 koku of semi-polished rice or 3 koku of unhulled graine As the formula suggests, all taxable land was assessed (and taxed) in terms of rice; even the tax on housesites was payable in rice.

[15] One must distinguish between this registered parcel of land (termed a hitsu, which was also the counter for such parcels) and a parcel of land in terms of cultivation (termed an osa, the counter for which was mai). The former was a bunded parcel of land registered to a single household, but for cultivation and water flow purposes, that parcel was

domain tax levies and domain enfeoffment grants, and the village so defined was assigned the collective responsibility for gathering the annual tax from each resident household and for meeting the full tax amount.

Such was the cadastre conducted in 1623-4 by the new lord Sakai Tadakatsu. Astonishingly, this survey remained the basis of domain holdings and land taxation for the entire 250 years of Sakai control of Shōnai. That is to say, the reclassification of land (most commonly, the conversion of dry-crop fields to paddy fields) and the bringing into cultivation of undeveloped gen'ya land required permission of domain authorities and entailed on-site surveying and registration. Because of this, there were periodical up-datings of the land registers and thus a gradual increase in the total registered holdings of the domain (its naidaka) and in the registered holdings (muradaka) of those villages with such changes and additions to arable land (YKS 1980:95-96). But Sakai's initial 1623-4 cadastre was never followed by a subsequent, comprehensive on-site cadastral survey of the domain. Furthermore, adjustments were never made in the kokumori formula to reflect rising land productivity through the centuries; the putative yield of 1 tan of grade #1 paddy land, for example, continued to be rated at 15 (or 3 koku of threshed, unhulled grain) throughout the domain period. Either a re-survey or an adjustment in the kokumori formula could have substantially raised domain revenues. Why neither was attempted is an issue returned to later in this chapter.

Domain taxation of the peasant cultivators consisted principally of the annual land tax (known as the honmononari, hontō nengu, or hontō torika) and secondarily of a number of ancillary taxes, surcharges, and corvee. The annual land tax, as noted above, was payable in rice by administrative village unit. It was determined by the application of a tax rate (men) to the village assessed yield (muradaka). Thus if a village with a muradaka of 400 koku had, for instance, a tax rate of 35%, its annual principal land tax would be 140 koku.

This tax rate (men) was determined annually by one of two methods. By the fixed rate method or jōmen-sei (also termed jōmen-tori), a constant rate was applied each year for a period of years (usually ten); the land tax was the simple calculation of this fixed rate times the village assessed yield. By the second method, the inspection method (kenmi-sei or kenmi-tori), adjustments were made to this fixed rate on the basis of a field inspection by assistants of the district deputy before harvest. A

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often sub-divided into a number of fragments (osa) by smaller, temporary bunds. I will return to this point again in chapter six because I believe that the rigidity of land registration tended to fix the field and ditching pattern, which grew more complicated with paddy land expansion. The only margin that cultivators had for reorganization was within the fixed hitsu.

reduction (nengu waribiki) could be granted if weather, disease, insects, or other factors threatened a below-average harvest.[16]

The former, fixed rate method was adopted by Sakai Tadakatsu in the 1620s, and by the 1660s, it was in use throughout the domain. The obvious advantage of this method was the fiscal stability of a fixed tax revenue from year to year. By the following century, however, the kenmi method of annual crop inspection was widely used, and still later, villages were permitted to petition the district deputy in the seventh month of the year for the application of either the fixed rate or a rate determined by crop inspection. This represented a further compromise of domain taxation procedures in favor of localities; from the village standpoint, the inspection method was of advantage in years of crop damage, while the fixed rate method prevented unnecessary inspections in other years.

Local historians (OA 1974:510) have calculated the mean domain-wide village tax rate for the years 1660-1866 to be 44.272%, with the highest mean of 48.517% in 1685 and the lowest mean of 31.091% in the following year, 1686. Such a mean is deceptive, however, because there was wide variation in the tax rate between land parcels and between villages. Although a tax rate per parcel was not fixed in the 1623-4 cadastre, it appears that some notation was made of the existing and customary levy on each parcel--and that this continued to serve as a guide for future annual tax rate. Old inequalities were preserved; furthermore, one form of promotion of acreage expansion was the fixing of a low tax rate on newly developed land. Thus, newer lands within villages and (downstream) villages with all or a majority of newly-developed paddy lands had much lower rates. As the tables of villages in the Nakagawa Main Canal and Shōryūjigawa Main Canal service areas indicate, village tax rates could range from about 30% to as much as 70%.

The application of the tax rate to the village assessed yield determined, then, the annual land tax due the domain, but domain administration had delegated to the village the task of producing this, that is, of assessing and collecting from its households. Unfortunately, here as elsewhere in Tokugawa Japan (Smith 1958:10-11), this internal process of distributing the village land tax is very poorly understood because few records remain which describe the decision-making. Formally, there was a simple way to subdivide the village tax among households. The

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16 These reductions were governed by a formula (sashibiki ritsu) that considered both the grade of the paddy land and the extent of damage. There were three categories of the latter: widespread, extreme, and total, but even in the last event (kaisai), only a 72% reduction in tax was granted. Even with the jōmen system, it was possible for a village to apply to the district deputy for a tax reduction in the event of a particularly poor harvest, a reduction known as teatebiki or yaburemen (OB 1974:10-11).

village land register (omizuchō)[17] listed each parcel of land with its assessed yield (bunmai); the bunmai of a household's holdings could be totalled and multiplied by the village tax rate to determine its share of the village tax. At the same time, it is easy to imagine several potential complications. Even within a village in any given year there would be harvest differentials due to differences in crop damage; we might also expect differences in the amount of under-taxed or non-registered land holdings among village households; and it is fair to assume that increases in land productivity (which with a fairly constant tax rate effectively reduced the formal tax claim) were realized differently through the village depending on land quality, irrigation-drainage conditions, cultivation techniques, and so on. Furthermore, whether--and how--these variables were factored into assessments to households depended primarily on the village headman, as the designated executive officer. It was he who possessed the village records and through him all communication with the domain had to pass.[18] His exercise of power would obviously depend on his relation to other registered cultivator households, the relative numbers of unregistered (non-land holding) households, selection procedures, personal characteristics, and other factors. We may expect, however, there to have been considerable variation among basin villages, given the divergence of actual circumstances from the land register figures and the range in the control exercised by the headman and/or a number of households in a village. Producing the village tax--the most important responsibility delegated it by the domain--could be a collective or elite process and could engender cooperation or conflict within the village unit. It is regretable that there are no examples of how this was actually handled.

The discussion of taxation to this point has referred specifically to the principal land tax, payable annually in rice before the last day of the year. In addition to the land tax, there were six other categories of levies due the domain by peasant cultivators. They are here briefly

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[17] Land registers (omizuchō) were prepared for each administrative village on the basis of the cadastral registers (kenchi-chō); the former were maintained by the headman of the village while the latter were retained by domain officials.

[18] His personal seal was required on all documents and petitions to higher officials and all directives from above were transmitted to him. The importance of record-keeping and access to the records is illustrated by the fact that a major demand in a widespread peasantemovement in Shōnai just after the abolition of the domain in the early 1870s was the right of villagers to inspect the official records kept by the village and village group headmen. See Makabe 1971:207-8 for a list of the many registers, maps, and notebooks held by the village headman in an alluvial fan village; the occasion for the listing was to acknowledge their receipt by the new headman from the former headman.

summarized:

(a) a surcharge (agemai) that might be added to the principal rice tax in certain years (agemai also referred to a sum subtracted by the domain from the fief income or stipend of the warrior retainers in times of domain financial distress).d

(b) miscellaneous taxes (uke-yaku). These included itemized levies for the salaries and administrative expenses of the village headman and other village officers; the expenses of the village group headman and the district deputy; for the upkeep of stables and road way-stations of the domain; for irrigation channel maintenance and personnel expenses; for certain domain public works projects; etc. These were generally payable in rice. One might also include here the several types of forced rice contributions (known as yonai mai). These first appeared in 1796 with the overt function of assisting distressed villages in meeting their tax obligations by building up a general reserve from which they might draw. In fact, it was a way by which the domain insured that shortfalls in tax payments by some villages could be covered by a reserve to which all villages had made forced contributions. One such forced contribution was a surcharge on the muradaka; another was a special levy on non-resident land holders.

(c) corvee. This category included labor requisitions for public works projects, for work in domain woodlands, for irrigation channel maintenance and repair, etc. By the mid-eighteenth century, most labor duties were in fact converted either to currency or rice equivalents and became additional miscellaneous taxes.

(d) miscellaneous commodities (komononari). As noted above, villages also had the obligation to deliver certain goods and commodities to the district deputy for distribution to certain domain retainers; a domain-wide formula scaled the quantities to the village muradaka. However, by the mid-eighteenth century, these too were converted to a cash equivalency and paid in metal coin.

(e) forced rice borrowings (tanebujiki-mai, "seed and food rice"). These were, officially, advances of rice made in the early spring by the domain to villages to meet shortfalls so that cultivators would have seeds for spring planting and food until harvest. They were payable after harvest at about 30% interest. In fact, these amounted to forced borrowings; apparently, often the spring advance was not even actually made--only the 30% interest charge (payable before all other taxes) was collected in the fall (see Naganuma 1964:164-5 for an example).

(f) inspection rice (kuchi-mai). The taxes payable in rice were delivered in woven straw bags made by the cultivator to domain specifications. The standard volume in Shōnai was 4 to (known as yonto iri),[19] but the cultivator was obliged to add an additional volume to cover rice taken out for inspection, in-transit leakage, and warehouse loss (rats, etc.). This was the kuchi-mai, and thus each bag was required to contain 0.4878 koku. Furthermore, because of extortion by warehousemen and the heavy penalty in the event of undervolume,[20] cultivators typically prepared bags of 0.53 koku (known as goto iri). The difference between 0.53 and 0.4878 koku was known as ashimai (Maeta, personal communication; Kamagata 1953:41).[21]

Given the numerous ancillary levies of the domain, it is difficult to calculate the total tax burden on villages and cultivators, but Maeta Teruhiko, a local historian of the Tokugawa period, has calculated total taxes in eight villages in the lower part of the Nakagawa Main Canal service area at the end of the domain period (see Table 2). Except for the anomalous case of Oshikiri-shimogumi, these totals are between 30% and 40% above the principal land tax and amount to 60-85% of village registered yield. They recommend the conclusion that the tax demands on registered lands were quite onerous.

The rice due from each village was delivered to a warehouse in each village group by the cultivators and there inspected by assistants of the district deputy. These warehouses were constructed and maintained at the expense of each village group; any fire, theft, and insect damage to the stored rice was also the responsibility of the village group. From there, the rice was transported either to the domain warehouses beside the castle at Tsuruoka or to the ports of Sakata and Kamo for shipment to and sale at

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[19] The measure box used in rice tax matters was the Edo-masu or osame-masu, which actually held more than the standard miyako-masu or harai-masu.

[20] Each bag had to contain the name of the cultivator and that of the district deputy assistant who inspected it at the village group warehouse. Volume was measured by special metal measure boxes (osame-masu), distributed by the district deputy. Bags were inspected randomly at several points. If a bag was found to be under volume, the entire village was assessed the shortfall times the total number of bags that the village delivered (Satō 1967).

[21] Sources for the categories of taxes include documents published in Satō 1967 and OB 1974:100-31. For examples of the documents from particular villages to the village group headman (such as the nengu-wari motokimechō) see OB 1974:110-3 and Naganuma 1968:164ff.

Table 2

Domain tax burdens on Oshikiri area villages (1850)

village	village registered yield (koku)	tax rate for principal land tax	est. sum of all taxes
Oshikiri-kamigumi	413.7038	47.3%	78.3%
Oshikiri-nakagumi	365.1025	47.3%	78.3%
Oshikiri-shimogumi	362.0327	47.3%	61.5%*
Sanbongi	208.3547	47.3%	80.5%
Tsushima	477.1962	47.3%	77.7%
Kami-doguchi	58.0887	49.0%	84.8%
Shimo-doguchi	639.4039	29.0%	62.0%
Yokogawa-shinden	139.6815	44.0%	84.4%

*As part of an agreement reached when a new village was founded below Oshikiri-shimogumi, the new village assumed the burden of about one-half of Oshikiri-shimogumi's ancillary taxes.

Note: The estimated sum of all taxes does not include requisitioned corvee lanor or the extra .03 koku added to each bag of tax rice as ashi-mai.

Source: OB 1974:112

Osaka and Edo (further details in OB 1974:14, 114-21).

One final feature of the administration and taxation system of the domain of relevance here was the rice voucher (bei-satsu) system that Sakai Tadakatsu introduced in 1624. Under this system, the tax rice was delivered to the domain granary warehouses, and retainers were issued vouchers for rice equivalent to their fief or stipend. Furthermore, if an individual cultivator household or village delivered extra rice, it would be issued vouchers for that.[22] The retainers would generally redeem the voucher only to the extent of his household needs and would sell the remainder of the voucher to rice merchants or other tradesmen to whom he owed money. The use of the rice voucher system greatly facilitated commercial transactions within the domain.

Developments in domain political economy

The chapter thus far has demonstrated that the thrust of early domain lord actions was to create a peasant stratum independent of all intermediate claims, organized into self-regulating village units, taxed by uniform and fairly onerous standards, and administered by a hierarchy of officials recruited from among the warrior-retainers. However close the first Sakai lords may have come to attaining this ideal (and given the turbulent times that preceded them, they were remarkably successful), there were important developments in the domain political economy which came to controvert it. This section briefly introduces three such dimensions of change:

(i) Beginning in the early seventeenth century with canal construction in the Aka River basin and continuing through the eighteenth century, there was a major expansion of irrigated paddy land into the formerly undeveloped downstream section of the drainage basin (that is, the central portion of Shōnai Plain). Although it was domain policy to encourage this expansion, the domain was never able to impose fully effective tax claims on this acreage.

(ii) Throughout the domain period, there was an increasing commercialization of agricultural (i.e., rice) production and distribution. Buying and selling of land, the use of commercial fertilizers, tenant farming, conversion of some tax levies from kind to cash, and greater prominence of merchants in rice marketing were

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[22] Conversely, in the case of tax delinquency, the household was forced to borrow from relatives, fellow villagers, or the district deputy. Payment in extra corvee labor (with the tax due treated as pre-garnisheed wages) or contracting a son or daughter as a servant to a warrior household were also common.

features of this commercialization.

(iii) Finally, there were the growing financial difficulties of the domain lord and warrior retainers on the one hand and of many of the peasant cultivators on the other. The obverse of this was the emergence of wealthy merchants and a few fortunate cultivators; their investments in paddy land led to increasing landholding concentrations in certain areas of the basin.

By the mid-1700s, these three mutually reinforcing dimensions of change had disrupted the original patterns of domain administration and tenure, significantly revising the political-economic context of Aka River irrigation.

Until the opening of the canal networks in the first decades of the seventeenth century, settlements in the Aka River drainage basin had been concentrated in the alluvial fan section; they were found in the downstream plain only along the high ground (e.g., the Kyōden area villages in the Shōryūjigawa service area and Yokoyama in the Nakagawa service area). In the seventeenth and eighteenth centuries, however, there was rapid expansion of paddy land throughout the drainage basin. Generally, this was of two kinds: (a) increasing the acreage of paddy lands within an existing village through conversion of dry fields (hatake-kaeshi) or previously undeveloped lands (kirizoe); or (b) the founding of new villages and the opening up of new lands primarily in the undeveloped wetlands in the center of the plain (shinden).

It is difficult to compute accurate figures for this expansion. Sakai Tadakatsu's 1623 cadastre registered over 53,000 koku of lands above the earlier domain total, reflecting both stricter procedures and expansion stimulated by the canal construction. Between 1623-1684, another 28,000 koku were added to official domain land registers, for a 1684 total of 219,000 koku, 1.59 times the 1611 figure. In the eighteenth century, expansion slowed, with much of the plain settled; between 1684-1758, the official domain total increased only 7,000 koku, with even more modest increases after that (OA 1974:295-6).

These figures, however, underrepresented actual expansion, in part because the domain employed several generous surveying and registration techniques to promote such development. These include the following:

(i) An initial tax-free period of three years was given all new paddy lands before first surveying and registration, which was done by officials of the district deputy's office.

(ii) New paddy fields were often deliberately undersurveyed. That is, based on the new equivalencies among land units promulgated by Hideyoshi and modified again by Ieyasu, Sakai Tadakatsu initially surveyed with the following scale:

1 bu = 1 tsubo = 1 ken X 1 ken (about 3.31 sq. meters)
1 se = 30 bu = 5 ken X 6 ken
1 tan = 300 bu = 5 ken X 60 ken
1 chō = 3000 bu = 50 ken X 60 ken (about .992 hectares)

One of the surveying instruments was a calibrated 1-ken pole (about 1.82 meters), and 5 lengths by 6 lengths of the pole would equal 1 se of land (for surveying techniques, see Iinuma 1974:11-15). For new paddy lands, however, the domain would measure with what was known as a "6-7 pole" (roku-shichi sao) or occasionally a "7-7 pole." A "6-7 pole" meant that 6 lengths by 7 lengths of the 1-ken pole would be measured as 1 se; that is, 1 se was in effect equal to 42 sq. ken rather than the official 30 sq. ken. This represented a 20% undermeasurement. Thus, for example, a small parcel of land surveyed with a "6-7 pole" and registered as 4 se in area would have an actual area of 4.8 se, 1.2 times the taxable figure appearing in the land register.

(iii) New paddy fields were also often undergraded. The same four grade system was used, but new fields were much more often rated the lower #3 or #4 than the higher #1 or #2 (see Kelly 1980:182). Of course, when developing wetlands, field conditions (such as a hard pan) may in fact have been inferior to older paddy lands, but they improved with cultivation; theredwas almost never any subsequent re-grading.

(iv) Finally, the newly-developed paddy lands might also be given lower tax rates than those on older paddy lands. As we will see later, within Kakuda-futakuchi Village, a downstream village in the Shōryūjigawa Main Canal service area, old (pre-1611) paddy fields had a tax rate of 41% while paddy fields opened in the 1600s were given a very low 20% rate (OB 1974:110).

Such concessions were used by the domain to encourage paddy land expansion and so maximize land resources in the domain in a way judged most lucrative and appropriate to domain revenues, rice production.[23] At the same time, it never directly underwrote such development, maintaining a strict distinction between encouraging agriculture, a proper duty of warrior-rank officials, and actually doing agriculture, the cultivators' obligation. It was also fearful of personal investment by officials in particular projects, which might dilute their dependency on the domain.

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[23] See YKS 1961:124-7 for the 1726 instructions for new paddy land surveying and registration and OA 1974:280-2 for the 1648 domain directive encouraging paddy land development. Occasionally, domain officials became alarmed at the pace at which development was taking place, however. As early as 1659, it issued orders declaring 22 yachi wetlands off-limits to development, fearing that the vital sources of animal feed grass and compost materials were threatened. The frequency of such orders suggests they were less than entirely effective.d

Expansion within existing villages was typically the initiative of some or all of the registered farmers, jointly opening up some yachi wetlands[24] or extending existing paddy lands into dry fields. In the Watamae area of the Nakagawa service area in 1717, twenty-three cultivators from Higashi-watamae Village and an equal number from Nishi-watamae Village developed an area of yachi shared by the two adjacent villages. In 1720, it was surveyed with a 6-7 pole to be 2 hectares in area (of which 0.15 hectares was dry field). A document attesting to the survey and signed by all forty-six participant cultivators contained two clauses common to such projectse (a) that they themselves would divide the parcels among themselves (as opposed to the district deputy officials who conducted the survey) and (b) that they promised that all existing paddy lands downstream of these new parcels would be accorded prior irrigation rights (in this case, the only downstream fields were within the same two villages) (Naganuma 1965e155-7). As we shall see later, this was a promise more often made than kept.

The format for the founding of new villages was somewhat different. Most commonly in the Aka River basin, village group headmen, village officers, and other peasant households with above-average holdings would initiate a petition to the rural magistrate's office. They would recruit potential settlers from existing villages (e.g., second and third sons of households with small or no holdings) who would exchange labor on common facility tasks (roads, temple, water channels, embankments, etc.) for an opportunity to develop parcels alloted to them by the shinden-gashira (the "new fields boss"). The project initiator would also recruit Tsuruoka or Sakata town merchants as financial backers (kane moto), who would supply funds, rice, and tools for initial development. Merchants themselves might initiate such projects but in much of the downstream areas of Shōryūjigawa and Nakagawa Main Canal service areas, the new villages were founded by large-holding cultivators from villages in the midstream areas. In the Nakagawa area, the Oshikiri villages were founded in the 1620s by the Yokoyama Village Group headman in Yokoyama Village (see the memorandum of permission in YKS 1980:546). His grandson in the 1660s organized Fukuoka Village downstream from Oshikiri, and in the 1710s, four cultivators from one of the Yokoyama villages founded Hirono-shinden Village.

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[24] Yachi or "marshland" was a common term for undeveloped land (gen'ya) on the plain. Their general boundaries were noted in domain registers and various usufruct rights assigned to villages (apparently following pre-domain period customary divisions in areas of older villages). Because these rights were limited to particular uses (such as grass cutting, firewood, earth collection), permission from the domain was necessary for development into arable land.

Hirono Yachi was a large tract of wetlands downriver from the Oshikiri-Yokoyama area on the east bank of the Aka River (see Map 8). In the fall of 1713, four cultivators from Yokoyama petitioned and received permission from the domain to found a new village in that section of the yachi land for which Yokoyama had usufruct rights. They claimed it was land capable of producing 3000 koku of rice. They secured financial backing fron two Sakata merchants, began work in 1714, and by 1718 had completed a canal from the tailend of Nakagawa Main Canal which became Hirono-shinden Branch Canal. A 1753 document listed total expenses of the development project at just over 3000 ryō in gold coin; calculated at 1 ryō = 0.6 koku, the mean 1714-18 rice price, this was equivalent to 1800 koku of rice (unpublished source #3). The document noted that channel construction and related expenses totalled about 100 ryō; the balance was used for building materials for 150 cultivator houses, expenses relating to two surveys, and "miscellaneous expenses." It is unfortunate that a further breakdown was not given; it would be quite valuable to know just how 'expensive' were the surveys and registrations conducted by the district deputy officials--to know, that is, to what extent bribes were necessary to receive generous concessions.

Narita-shinden Village, founded across the Aka River at the tailend of the Shōryūjigawa Main Canal service area in the triangle of yachi land where the Aka River was joined by its Ōyama tributary, is a better documented example of new villages (see Map 4).[25] This settlement was planned by Narita Heizaemon, who was the Kyōden Village Group headman, living in Naka-kyōden Village in the 1650s. His background was a common one for early village group headmen. He was the third son of a minor warrior vassal of Hideyoshi; his father committed suicide with the final defeat of his master and entrusted the three-year old Heizaemon to a retainer, Narita Sanzaemon. Narita fled Osaka to Shōnai and was allowed to settle in Naka-kyōden. While not retaining his warrior status, he was made village group headman, a post Heizaemon succeeded to.

In founding Narita-shinden, Heizaemon was joined by at least nine other farmers from Kyōden area villages, including at least one village headman; documents indicate that backing was secured from at least five domain warrior-rank persons, including Kōriki Kuhei, who was soon to become domain rural affairs officer (gundai). This support suggests that domain fears of officials' personal involvement in projects had some substance, although little other evidence is available.

The new village was opened in 1658, and Narita Heizaemon lived there until his death 29 years later in 1687. Both his son, who continued as village group headman, and his grandson remained influential in

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[25] Documents about Narita-shinden have been collected in a volume of village history compiled by Ōse in 1952.

Narita-shinden until 1718 when the household line died out.[26] The son married a woman from the founding household of Aoyama Village; Heizaemon negotiated with Aoyama for an extension of the Aoyama Branch Canal, though the relation between these negotiations and the marriage of his son, however tantalizing, remains without proof. The grandson married a woman from the Kudō household in Hongō Village; this was the Kudō household which organized original construction of the Shōryūjigawa Main Canal.

Table 3 presents material from the Narita-shinden land register on annual increases in the village registered yield. It indicates that in the first twelve years about 97 hectares of land assessed at 630 koku were opened up. Thereafter, development slowed, with only an additional 75 koku added between 1670-1700 and only minimal amounts later. This pace further illustrates the point that most expansion in the Aka River basin apparently occurred in the first hundred years following main canal construction. A 6-7 pole was generally used, and most of the paddy lands were given the lowest #4 grade. Some measure of the extent to which land in Narita-shinden was undersurveyed is gained by comparing the acreage figure of about 110 hectares at the end of the domain period with the 1875 figure (following the Meiji land tax cadastre) of 160 hectares, the latter being 145% of the former.

The Narita-shinden records also illustrate that the two essential preliminary tasks of new village settlement were flood protection and irrigation-drainage. Narita-shinden was particularly vulnerable to flooding as the Aka River tended to back up where it met the coastal dunes at Kuromori and was deflected to the north. The initial project of the villagers was to construct two earth embankments along the river banks. The first was a 2730 meter embankment along the Aka River from Inoko Village to the confluence point; the second was a 3276 meter embankment along the Ōyama River from Obana Village to the Aka-Ōyama confluence. Furthermore, an agreement was negotiated with Obana about the maintenance of a lateral embankment perpendicular to the Ōyama River embankment and mid-way between the two villages. We will see below that this became the source of considerable inter-village discord.

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[26] Actually, the story told by the village records is that the grandson was sentenced to die and was executed (or allowed to commit suicide) following a financial scandal. He had borrowed 100 ryō from a Tsuruoka merchant who in turn had borrowed a large sum of money from a warrior of the Matsuyama Branch Domain--and then defaulted. After an appeal to Shōnai Domain officials, both the merchant and Narita were arrested, the latter accused as an accomplice. The grandson had two sons, both of whom held minor posts in the domain administration (perhaps they had been adopted out). They quarreled over succession to their father's household line; the eventual result was that the line was discontinued.

Table 3

Arable land development in Narita-shinden Village

year	registered yield	
1660	11.1970	koku
1661	84.4635	
1662	203.9521	
1663	40.2582	
1664	35.3910	
1665	57.5936	
1666	23.7897	
1667	2.8800	
1668	18.9300	
1669	0.3840	
1670	10.5300	
1670*	141.4786	
(1660-70 total)	(630.8477)	(approx. 97.3 hectares)
1671	1.297	
1673	4.131	
1674	8.025	
1675	2.4264	
1676	0.8700	
1677	13.0794	
1679	7.0600	
1680	13.6540	
1686	2.1378	
1692	2.1060	
1695	7.9710	
(1671-1700 total)	(703.3990)	(approx. 109.4 hectares)
1724	3.9600	
1749	1.0869	
(c. 1860 total)	(708.4459)	

*This amount of 141.4786 koku refers to land previously developed but newly registered in 1670 following a survey in the village.

Source: Ōse 1952

Second, irrigation-drainage ditching was necessary. The first attempt was to draw water directly from the Aka River, but this failed. Construction was not difficult but the intake washed out easily in high water, and there was no flow in the dry summer months. So negotiations were concluded with the three villages along the Aoyama Branch Canal to extend the canal and use its water. Details of Narita irrigation are taken up in a later chapter, but its unsuccessful efforts to tap directly into the Aka River are a reminder that almost all paddy land development in the Aka River basin had to be integrated into the existing main canal networks.

There was, in sum, significant expansion of paddy land acreage in the drainage basin, and throughout the domain, particularly in the years between 1600 and roughly 1750. Paddy land development was actively promoted by the domain to increase domain land tax revenues as an alternative to increasing the tax burden on developed paddy lands. Yet the very techniques of promotion undermined the ability of the domain to appropriate fully the surplus production of the new lands. Rather, the new areas were attractive opportunities for private gain, both in the initial development and in later years. Moreover, the generous concessions granted by the domain established a clear differential between the tax burdens of old and new paddy lands. As the example of the Watamae villages illustrates, most development within existing villages was undertaken by some or all of the registered cultivator households joining together to expand their paddy field areas. In contrast, in thee downstream plain where new settlements were founded within the undeveloped yachi lands, initiative was generally taken by a small group of well-to-do peasant cultivators, including village group headmen and village officers from surrounding villages. As seen in the cases of Hirono-shinden (Nakagawa) and Narita-shinden (Shōryūjigawa), they were able to attract both the necessary cultivator-settlers and needed capital investment in the form of loans from merchants, and they could secure the required domain permission.

Along with the extension of paddy land acreage throughout the Aka River basin, a second dimension of change in the domain political economy was a growing commercialization of agricultural production and distribution. This, of course, is an often noted characteristic of the entire Tokugawa agrarian state, though the nature and degree of commercialization varied regionally. In the Kantō and Kinki areas, near the urban centers of Edo, Kyoto, Osaka, etc., commercialization often meant a shift from irrigated rice to more lucrative cash crops such as cotton, rape-seed, beans and other vegetables--or at least, a more intensive double cropping of these cash crops in paddy fields (see Hauser 1974). Even in northeast Japan, in domains like Morioka, gold mining, horse breeding, fishing, and timber generated much commercial activity (Hanley & Yamamura 1978e126-37). In Shōnai, however, distant from the primary markets, without mineral resources in its mountains and unable to compete with inland areas in sericulture, rice remained the only marketable commodity. With the

exception of vegetable gardens for home use and some dry-crop fields to supply the domain town population, the plain was monocropped with irrigated rice. Here, commercialization only increased attention on rice cultivation.

It was an unintended consequence of the domain's centralized collection and warehousing facilities and its use of rice vouchers that the commercial marketing of rice was expedited. Official domain surpluses (collected rice above domain lord household consumption, retainerd stipends, and other expenses) were consigned to merchants and ship chandlers in Sakata and Kamo, who marketed them in Osaka and Edo. These port merchants also handled marketing for the inland domains as it was easier to ship rice down the Mogami River to Sakata than to transport it overland to Edo. Domain warrior retainers received their fief stipends in rice vouchers, only part of which they redeemed for rice for household consumption; the rest would either be used to pay off debts to town merchants or sold to the port rice merchants for cash.

The basic rice tax was always paid in kind, but increasingly other duties came to be collected in cash--miscellaneous commodities (komonorari), miscellaneous duties (ukeyaku), even corvee duties were sometimes paid by cash equivalent. The system occasionally used by the domain by which public works projects were handled by contracts let to Tsuruoka townspeople rather than conventional domain supervision ofdcorvee laborers is further indication of a shift towards a cash economy.

Domain directives constantly reflected concern with this growing commercial activity and its destabilizing effect on collection of taxes and duties. There were orders against merchants going to villages, against any rice sales before payment of taxes at the end of the year, and against taking time off from cultivation activities beyond the official domain holidays to seek temporary work in the towns, among other examples.[27] Of course the repeated issuance of such directives only underscores their ineffectiveness.

The domain's lack of success in restricting the commercialization of rice agriculture was related to a third dimension of change in the political economy, the mounting financial difficulties of both the domain (its official accounts and the private household economies of warrior-retainers) and many peasant cultivators. By the 1700s, the domain lord and the warrior elite collectively were drawn into heavy debt, committed to a life-style and level of expenditure that was economically unsustainable and mortgaged to the increasingly merchant-centered economy

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[27] For strictures against town-village contacts, see for example the 1661 order in OA 1974:292. In 1818, the domain announced a 300 mon penalty for any field hand (wakaze) reported for quiting before 3 pm (haya-age) or for taking an unauthorized holiday (oshi-yasumi) (OB 1974:96).

that was undermining its agrarian base and political authority. At the same time, the system of administration and land tenure implemented by the first Sakai lord to centralize political authority and to stabilize extraction of peasant surplus at a maximum level by creating an independent peasant cultivator stratum contained features which could trigger a downward cycle of impoverishment from which many peasante households could not escape.

Historians of the domain have found that its finances took a serious turn for the worse in the mid-1700s during the rule of the seventh lord, Sakai Tadayori, in 1731-66. There had been a prolonged slump in the rice price during the Kyōhō era (1716-36). Tadayori's marriage, just after assuming the lordship, to the adopted daughter of Maeda Tsunanori, lord of the largest domain, Kaga, was very costly. This was followed by a particularly heavy levy by the shogunate for repairs to the Tokugawa family shrine, Nikkō Tōshōgu Shrine, in 1739.[28] In 1749, Tadayori was named to the shogun's Senior Council (rojū), which entailed numerous ceremonial expenses, and in 1760, he served a high (and thus costly) role in the installation of the new shogun. There were, moreover, major crop failures in 1755 and 1763, and in 1751, there was an extensive fire in the port of Sakata which destroyed 2450 houses and 41,000 koku of rice. By 1774, the domain debt was between 80,000-90,000 ryō; debt servicing alone amounted to 15,000 ryō annually, and that year the domain ran a total deficit of 27,000 ryō, or roughly half the value of its total rice income for the year (Table 4; see Honma & Yokoyama 1975:187ff. and Satō 1975:184-94 for these and other details of Tadayori's fiscal problems).

The domain lord--or perhaps more properly, the council of senior advisors--attempted to meet these problems by turning to the warrior-retainers and to the merchants. In 1741-42, all retainer stipends were suspended and replaced with smaller "allowances" (onmakai), and in 1760, all stipends were reduced 18% for that year (a reduction termed age-mai). Thereafter, such temporary suspensions or reductions were intermittently reimposed. Increasingly, however, the domain came to rely on the financial resources of the merchants. It secured loans at commercial interest rates from large traders and rice dealers in Osaka and Edo and continuously sought a variety of "contributions" (daikenkin) and "loans" (saikakukin) from merchants in Tsuruoka and Sakata. The practice developed of soliciting these 'voluntary' donations in return for warrior-rank privileges such as use of surnames, sword, and certain gate embellishments and for honorary official posts. At times these postings were more than honorary; in 1776, Honma Mitsuoka, the leading Sakata merchant and by then the largest landholder in the domain, was appointed honorary domain financial officer (omotojime-kaku) and was asked to devise

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[28] Domain lords were not taxed directly by the shogun, but they were expected to make 'contributions' to shogunate projects when requested or assessed.

Table 4

A summary of domain finances for the year 1774

INCOME		EXPENDITURES	
rice income*		**rice expenditures**	
10-yr. annual mean, basic land tax	210,000 bags	domain lord household, retainers' stipends, etc.	172,000 bags
miscell. taxes	27,000 bags		
TOTAL	237,000 bags	TOTAL	172,000 bags
cash income		**cash expenditures**	
miscell. taxes	8,900 ryō	interest on debts**	15,000 ryō
forced surcharge on retainer stipends	11,000 ryō	miscell. expenses, Edo & domain	48,000 ryō
TOTAL	19,900 ryō	TOTAL	63,000 ryō

Notes: The 65,000 bag rice surplus was marketed to help meet the cash deficit. Sold at 10 ryō = about 40 bags, this raised about 16,000 ryō. Thus, the total deficit for the domain in this year was 27,100 ryō (or roughly one-half of the domain's rice income for the year).

*This is based on a total domain registered yield of 191,000 koku (converted to bags of rice, this equals 477,500 bags).

** This is interest on a total outstanding debt of 80,000-90,000 ryō.

Source: This summary has been compiled from a table in OA 1974:346. Professor Robert J. Smith has noted a discrepancy in dating between this table and Tsukahira 1966:84-85. Tsukahira cites a report written "by an official of the Sakai han" at the "beginning of the eighteenth century" which contains the same bugetary figures as the above table. Tsukahira's source is a 1935 article by Date Kenji. Date, in turn, had taken the report from a late eighteenth century collection of domain documents known as the Ōizumi hyakudan, compiled by Matsuyama Gien (1738-1811; see OZ 1974:752). Date believed the report (which he termed a memorandum) to be from the Hōei era (1704-1711; see Date 1935:391).

Ōse et al., citing only the budgetary figures and not the full text, attribute them specifically to a 1774 petition

Table 4 (continued)

(kenpakusho) by the domain elder, Mizuno Kageyu, in which he noted the very poor state of domain finances. The most recent setback had been the special 29,000 ryō assessment for the 1772 rebuilding of the domain lord's Edo residence. The petition proposed that the personal allowance for the domain lord be reduced by half for a period of seven years to stem the mounting debt (ibid.:345)a Without the full text of the document, the difference between Date's surmise and Ōse et al.ds dating cannot be resolved, but I give more credence to the latter.

a three-year budgetary program for eliminating the domain debt. As he had contributed over 5000 ryō and 8000 koku of rice in the previous decade, he would appear to have had a more than impersonal interest in improving domain finances. There was apparently some improvement in the domain position, but as a result of several poor harvests and a shogunate 'request' for 22,000 ryō in the 1780s, domain debt was up again to 100,000 ryo by 1793 (see Satō 1975:198-212; 1976:68-91; OA 1974:342-64).

In view of these mounting financial problems and the wide expansion in paddy lands that had occurred in the previous one hundred years, it is striking that the domain did not attempt to restructure its claims on agricultural production and producers. As I have pointed out above, the 1623-4 cadastre was never followed by another such on-site survey, there were no revisions in the kokumori formula, and the basic tax rate remained fairly constant throughout the period. The only record of such a move being contemplated dates from the early 1750s, when one of the domain rural affairs officers (gundai) proposed a new cadastral survey to eliminate the promotional concessions that had been granted the new paddy lands (shin-sao uchinaoshi were the words used). This plan was approved by one of the domain elders but was opposed by the other rural affairs officer, who feared it would overburden the peasants and lead to more tax delinquency and non-payment, which district-level officials would have to cover by private lending. No action was taken on the proposal (Satō 1975:189-90).

The reluctance to undertake new land surveys, to revise registration standards, and to raise substantially land tax rates is a common characteristic of Tokugawa period domains, and one that remains puzzling to historians. Smith (1958e5) and others tentatively suggest it was due to a fear of peasant resistance. This was certainly true in ateleast some circumstances; Hanley and Yamamura recount the massive uprisings that followed attempts by Morioka Domain to raise levies on several commercially profitable commodities of the domain (1977:137-44).

It is difficult to evaluate the degree to which there was a fear of general resistance to such action in Shōnai. Ironically, one of the few recorded cases of widespread collective (and successful) resistance came in 1840 in support of the domain lord and in opposition to a shogunal order removing the Sakai lord from Shōnai to a smaller domain (Nagaoka) and installing a new lord.[29] I do believe, though, that in the case of

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[29] The order met with vigorous, sustained resistance not only from peasant cultivators but also from lower-rank retainers, who feared the move to a smaller domain would mean losing their position, and from merchants, who not only feared that the new domain lord would conduct a new land survey but also that he would hardly feel bound to honor the substantial debts of the former Sakai lords (see Saitō & Satō 1957:105-16; YKS 1980:935-1019).

Shōnai a more compelling reason for not conducting a new cadastral survey and raising tax standards was to be found in the reliance on merchants for financial aid in moments of particular need. As we will see, these same merchants in the mid-1700s began investing in paddy lands, especially the new, lightly taxed paddy lands, and they would have been particularlye affected by such changes. In a sense, staying afloat fiscally by periodic 'contributions' from domain merchants was simply an alternative to overhauling the survey and taxation methods; once the former method became habitual it was most difficult to attempt the latter as well.[30] There is no direct evidence that the 'contributions' were actually seen as the price for a continuation of relaxed taxation levels on newer paddy lands, nor have I the evidence to conclude that one or the other was more profitable and/or preferable to domain officials or the merchants. It is clear that the domain reliance on merchant money and merchant investment in lightly-taxed paddy lands were two features of the latter half of the domain period, and I will hypothesize that the resulting configuration of peasant cultivators, domain officials, and such large landholders was decisive in accounting for the peculiar pattern of decentralized irrigation in the domain's major river basin.

By the mid-eighteenth century, economic difficulties came to plague peasant cultivators as well as the domain and domain retainers. Here it must be noted that the general issue of peasant indigence and prosperity is currently a subject of much debate among scholars of the Tokugawa period. Until recently, the orthodox view among Japanese and foreign scholars was that both the Tokugawa rural economy and population stagnated in the second half of the period; onerous taxes and frequent famine brought unrelieved peasant desperation. However, the thrust of much current research is to demonstrate that the rural economy was actually steadily improving throughout the period. Hanley and Yamamura (1977), representative of this new scholarship, marshal considerable evidence to argue that by the early 1700s, population growth declined while the economy continued to grow through rising agricultural productivity, commercial expansion, technological improvements, and so forth. There was, they and others now believe, a general rise in the standard of living in the countryside which continued through the Tokugawa period and presaged the successful modernization of the Meiji era.

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[30] Chambliss, too, in his study of Chiaraijima Village in the northwest corner of Kantō Plain, has advanced a similar argument. He estimated that the extraordinary taxes on peasant commercial activities and the forced loans from peasant traders totalled three times the domain's income from the basic land tax. He concluded that "...this heavy financial reliance on peasant traders may go a long way in explaining why the domain permitted the land tax to remain so low during the late Tokugawa period" (1965:60).

It is beyond my purview and intention here to place Shōnai Domain in this new model of the Tokugawa economy, but it is necessary to caution against drawing too rosy a picture of the Shōnai countryside. To be sure, there is little evidence of a general, unrelieved impoverishment among Shōnai--and more directly to the point of the this study, Aka River--cultivators. During years of famine, there were vague claims of "several thousand" deaths from starvation,[31] but little support can be found for waves of famine regularly decimating the population. Given the undersurveying and undergrading of newer paddy lands, it is of course very difficult to determine whether there were significant increases in land productivity, as proposed by the new model of the economic historians. The only data which can be cited with any confidence are mixed. Satō (1965:69) has used internal village records (the bugari chō) for three villages in the downstream area of Shōryūjigawa (Kakuda-futakuchi, Shin-kōya, and Harima-kyōden Villages) together with records of a local large landholder to estimate the following yields per 1 tan (about 0.1 hectare)--that is, per one actual tan:

1780-1800	1.3 to 1.5 koku
1800-1830	2.1 to 2.2 koku
1830-1850	1.6 to 1.7 koku
1850-1870	1.7 koku

These figures suggest significant fluctuation within an overall rise in land productivity. Still, if we recall that the official domain assessment throughout the period ranged from 1.5 koku per tan for #1 grade paddy land to 0.9 koku per tan for the lowest #4 grade, it is obvious that a #3 or #4 graded parcel that was measured with a 6-7 pole would yield a considerable margin above domain tax duties.

On the other hand, if general poverty and stagnation is an inaccurate description, there is much to suggest that basin peasants did not benefit uniformly from an improving standard of living. Unlike even other domains in the less developed northeast, there were no significant commercial opportunities other than rice in Shōnai, and while we do not have many quantitative data on annual harvest fluctuations, the nature of basin climate, soil, and water discussed in chapter three provide strong circumstantial evidence for yield instability.[32] This was compounded bye

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[31] For example, a 1708 petition from eight village groups claimed that "several thousands young and old, men and women had died of starvation following several years of continued poor harvests (Makabe 1971:202).

[32] Uno's analysis of the bugari-chō of Toyohara Village (Toyohara kenkyūkai 1978:533-544) from late Tokugawa and early Meiji suggests that in better years, yields averaged around 2 koku per 0.1 ha, and in poor years, around 1.5 koku per 0.1 ha. A report by a prefectural official in early Meiji assessed the yield of what appears to have been the predominant rice variety group of theelate domain period in the

the numerous tax duties themselves, which could reach an onerous 80-90% of registered yield in some areas; implementation of the fixed tax rate method (jōmensei), which permitted much more niggard reductions in bad years than the inspection method; forced borrowings of seed rice from the domain, which were then payable with 30% interest before the next autumn taxes were due; and heavy penalties for tax delinquency. As a result, there was considerable peasant borrowing and indebtedness. By means of private arrangements with other villagers, pawning of land to towne merchants, and outright sales, land transfers became common as peasant debt increased.

Contributing to the severity of such a downward spiral of increasing debt and eventual loss of all land was the differential in the desirability of land, especially between old paddy lands and newly developed and more lightly taxed paddy lands. A household might have parcels of each within its village, but if it were forced to seek a loan, it would have to put up its lightly taxed new paddy lands as collateral. If it were unable to redeem and lost this land, it would be in an even worse position to maintain itself in later misfortunes and would have more difficulty in finding a lender for its more heavily taxed lands. In the latter case, or where all lands were highly taxed, a household might transfer its tax duties on one parcel to another parcel to make the first parcel (known as a takanuki-ta) more attractive as collateral. The strategy, however necessary at the moment, was usually sef-defeating as the duties on the second parcel (a takabari-ta) were only more onerous.

We know that peasant debt and consequent land transfers were serious problems but we do not know just how widespread they were. One solution to hopeless indebtedness was simply to leave one's village (a tsuburebyakushō) and migrate elsewhere. Migration to towns and cities within and even outside the domain was increasingly attractive with rises in wages, and we may presume that at least in the first part of the period the settlement of the downstream areas of the basin offered an escape for distressed and heavily indebted households to start afresh. In either case, the responsibility for meeting the taxes on such abandoned land reverted to the village collectively (as mura-age chi), and it was necessary to delegate cultivation responsibility to another villager. By the mid-1700s in Hayashizaki Village in the Shōryūjigawa Main Canal service area, 43% of village lands had reverted to the village; in Yokoyama-shimogumi Village in the Nakagawa Main Canal service area, the comparable figure was 42%, and in Fujishima Village in the Inaba Main Canal service area it reached 50% the same year (OB 1974:95). As a measure to prevent this trend from undermining tax payments, the domain rural affairs officer in 1795 ordered that all villages reassign full

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center of Shōnai Plain in the following terms: of five harvests, these varieties produced below-average yields three years, an average yield one year, and above average yields one year (Igawa 1967).

proprietorship of these reverted lands to individual households (these are so designated in the land registers by the notation nushi-tsuke after the cultivator's name; see the 1800 record of assignments in Hayashizaki Village in YKS 1980:395-409). This no doubt led to much maneuvering within villages to avoid particularly heavily taxed plots; the overall effect was to increase the potential for indebtedness of the remaining households.

Thus, while a rising standard of living may have characterized the overall Tokugawa economy, the situation in Shōnai Domain and in its Aka River basin was more complex. Peasant difficulties in meeting domain levies in the face of unpredictable harvests led to rather serious cumulative peasant debt, but these difficulties were differentially experienced. There was no general impoverishment but still only selective and, in many cases, tenuous prosperity.

For our purposes, there are two consequences of the mixed and fluctuating fortunes of the basin peasantry that need to be underscored--the continuous land transfers that followed the borrowing and lending upset the congruence of residence, cultivation rightsę and tax liability upon which the domain system rested and they resulted in concentrations of large land holdings in certain parts of the basin. Both consequences had important implications for the relations among domain officials, peasant water users, and large landholders in irrigation organization.

Domain control of production and producers was predicated on independent peasant households, cultivating and paying taxes on land within their village of residence. Thus land transfers in any form (except impartible inheritance) andethe fragmentation and dissolution of holdings threatened the very stability of the domain system. It is not surprising then that all such transfers (pawning, sales, division among children, etc.) were prohibited by domain decree; in 1643, the shogunate had issued its first order prohibiting land sales (the eitai baibai kinshi rei) and in 1678, the domain issued the first of a series of such orders. Predictably, these did little to actually prevent land sales and transfers, and eventually there was even some administrative relaxation which officially countenanced certain fixed term loans with land collateral to pay land taxes.

The congruence of residence, cultivation rights, and tax liability was upset in several ways by land transfers. We have seen how land abandoned by fleeing peasants amounted to over 50% of a village's registered yield in some cases; the domain was finally forced to reassign formal liability for these parcels to remaining households. A household that lost its land holdings but remained in the village could lose its registered cultivator status (as honbyakushō). This contributed to the growing number of untitled households (mizunomibyakushō) and dependent agricultural laborer households (nago).

Land transfers also led to an increase in the number of cultivators working parcels in villages other than their own. As early as 1689 in Kakuda-futakuchi Village, almost one-quarter of the village land was cultivated by a total of fourteen persons (irisakunin) from six surrounding villages; at the same time, seven Kakuda-futakuchi residents cultivated about 110 koku (12 hectares) of land in six villages (four of these villages were the same as irisakunin villages)e The proportion of Kakuda-futakuchi lands cultivated by non-residents jumped to over 50% in 1734 and remained there for most of the domain period (OB 1974:132).

Transfers of land through sales and loan defaulting not only disrupted the ideal congruence of residente= tax payere= cultivator but also led to concentrations of land holdings in some areas of the basin. In the seventeenth century, even many of the larger holdings were cultivated by the owner with hired labor from land-poor households, but rising wages combined with a prolonged slump in the rice price in the Kyōhō era (1716-35) made it increasingly difficult to attract and support sufficient labor. By the mid-1700s, therefore, self-cultivation of large holdings was replaced by tenancy and sharecropping, particularly in the downstream new paddy lands. It was also at this time that merchants from Tsuruoka and the ports of Sakata and Kamo began to accumulate large land holdings through lending to peasants, outright purchase, and contributions to land development.

Most research on these merchant landlords has focused on the Honmas, originally ship chandlers, money lenders, and rice traders in Sakata. Their first land purchase was made in 1736 by the third generation Honma Mitsuoka; by 1800, they had holdings of about 600 (actual) hectares producing a rent of almost 6000 koku (Honma & Yokoyama 1975:190)e By then, Honma was not only the largest landholder but also the richest merchant in the domain, and his 'donations' of money and fiscal advice were repeatedly sought by the domain lord. The Honma holdings, though, were concentrated in lands north of the Mogami River, and the family's influence in the Aka River basin was only indirect.[33]

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[33] Igawa (1967) has studied the distribution of Honma holdings in the mid- to late domain period, showing that they were concentrated at the very downstream section of the Nikkō River alluvial fan and in the downstream floodplain between the Arase and Aizawa Rivers. These were areas of newer paddy lands, threatened by both flooding of only partially controlled rivers and water shortages; still they were attractive because of their low tax burdens. Many of the voluminous Honma family records have been published as the Honma-ke Shozō Shiryō-shū, available at the Shinjō branch of the MAF's Agricultural Research Institute. There is a large literature on "landlordism" (jinushi-sei) in the Shōnai area, but it must be used with caution. Most works are by economics-oriented agricultural and rural historians and agricultural economists; they are frequently addressed to the

South of the Mogami River in the Aka River basin, there was no single, dominant landholder like Honma. Instead, there were smaller accumulations by a number of both wealthy peasants and merchants from Tsuruoka and Kamo. Unfortunately, with the present evidence it is difficult to determine their total holdings and numbers, although I estimate from an 1829 list of wealthy commoners in the domain (the chōja banzuke; OA 1974:384, Tawara 1972) that there were at least sixteen persons with several hundred koku in paddy land in the Aka River basin. These included four peasants in the Shōryūjigawa service area, three in the Nakagawa service area, and one in the Inaba sevice area, plus seven merchants in Tsuruoka, Ōyama, Kamo, and Sakata. There were probably tens more of merchants and peasants with lesser amounts of tenanted land which had been purchased or collected as the collateral on unpaid loans, but there are no data on this at the moment.

There are a few details known about three of these landholders: Akino, a merchant and trader of the port of Kamo; Satō Tōzō, the headman of Kakuda-futakuchi Village in the Shōryūjigawa area; and Abe Tokusaburō, a peasant cultivator in Sanbongi Village in the Nakagawa area. Together they suggest some of the characteristics of large landholders in the Aka River basin.

The Akinos maintained warehouses and ships at the port of Kamo, trading Shōnai rice for salt, cloth, and pottery at Osaka and Kyoto. They made their first land purchase in 1745, and by the end of the 1700s, they were the largest landholders in the basin--indeed, they were second only to Honma in the entire domain (see Table 5). Even so, Akino holdings, which totalled about 117 hectares in 1845, did not exceed 3%-4% of the basin acreage. The villages in which they accumulated large holdings were generally around the town of Ōyama, both to the north along the west bank of the Ōyama River, which was an area of major paddy land expansions in the late 1600s and 1700s, and to the south in that small corner of the basin irrigated by the upper Ōyama River (see Table 6). Only 6.3 hectares, or 5% of their holdings, were within the Shōryūjigawa service area (see Mori 1975 and Kudō & Akino 1966:99-135 for further details).

Most of the lands of the Abe household of Sanbongi Village were accumulated in the period 1775-95; in 1797, the household had 193 tenants in 29 villages from which it was collecting just over 1000 koku of rice per year.[34] The Abe holdings illustrate two important features of large

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rather polemical Japanese Marxist concern with whether the Meiji Restoration was or was not a bourgeois revolution (see Nagai & Kudō 1951, Satō 1965, Igawa 1967, Tawara 1972, and Baba 1965).

[34] A typical tenancy agreement would assign cultivation rights for a parcel (known as a hyōta) to a household, which would supply all labor, seed rice, tools, etc., in return for paying tothe landholder a rent

Table 5

Increases in Akino paddy land holdings expressed as rent rice

1749	36.0 koku
1754	66.8
1759	168.0
1764	189.6
1769	193.6
1774	203.6
1779	288.8
1784	310.0
1789	359.6
1794	423.6
1799	474.0
1804	547.2
1809	686.8
1814	917.2
1819	1039.2
1824	1262.0
1829	1373.2
1833	1435.2
1838	1477.2
1845	1520.4

Note: Figures represent total paddy land holdings in the above years, expressed as koku of rental rice. That is, when purchasing a parcel of land and assigning it to a tenant, Akino's agent would measure the parcel and assess its productivity; this would be based on an on-site survey and thus might bear little resemblance to the entries for the parcel in the domain land register. A rental rice figure would thus be determined--the amount of rice in 0.4 koku bags due from the tenant; the rent included both owner profit and domain taxes.

Source: YKS 1968:645

Table 6

Distribution of Akino holdings, 1845

villages along west bank of Ōyama River (12)	
Ōyama	3.6 hectares
Tomoe	2.0
Nakadate	1.9
Umachō	21.3
Shimogawa	10.2
Chiyasu-kyōden	5.0
Omotenoyama	3.2
Tsuji-kōya	34.1
Nagasaki	12.7
Ibara-shinden	5.4
Nishi-nonuma	5.8
Hirooka-shinden	4.1
villages within Shōryūjigawa Main Canal service area (8)	
Inoko	0.1 hectares
Obana/Tenshindō	0.1
Narita-shinden	1.1
Higashi-nonumad	1.1
Zennami	0.3
Kakuda-futakuchi	3.3
Arai-kyōden	0.3

Total land holdingsd= 116.6 hectares
Number of villages in which holdings were distributedd= 19

Source: Kudō and Akino 1966:110-111, 121

landholders in the basin area (see Table 7). First, they were concentrated in those areas that were lightly taxed, that is, they consisted largely of parcels of newly developed paddy land. Of the 1000 koku in rent which Abe collected in 1797, only about 15% (150 koku) was due to the domain as tax; the remaining 85% (850 koku) was income to the household. Parcels in 17 villages let to 69 tenants had no tax duties at all.[35] Abe's holdings also indicate that the paddy lands of such large landholders tended to be distributed across a number of water course service areas. Abe had parcels in four main canal service areas in addition to several Ōyama west bank villages. This is a critical point because I will argue that this dispersal of holdings diluted the influence and concern of these large holders in irrigation affairs.

The third basin landholder about which some details are known is Satō Tōzō of Kakuda-futakuchi. The head of this peasant household was hereditary headman of the village, but household holdings were much smaller in scale that Akino or Abe. In 1794, Tōzō held 11.8 hectares of land with an assessed value of 134 koku. Even so, the holdings were distributed through several villages. They had 38 paddy land parcels, 8 dry field parcels, and 4 rice nursery parcels in Kakuda-futakuchi (5.3 hectares), Zennami (2.9 hectares), Naka-kyōden (1.6 hectares), and Higashi-nonuma (1.2 hectares), with very small plots in five other villages. The household cultivated 1.6 hectares of this total, mostly within Kakuda-futakuchi, and let out the remaining 10.2 hectares (the 1794 Tōzō register is in YKS 1980:605-615).

(known as kosakuryō, watarikuchi-mai, or hyōtawatari). A standard rent was 3 bags of rent per 100 sheaves of harvest grain (about 1 tan or 0.1 ha). From the rent, the registered landholder was responsible for all taxes; what remained after these payments was his income, known as sakutoku-mai. In practice, however, because taxes were collected in the village in which the parcel was registered, the tenant often paid the taxes and delivered the remainder of the rent, the sakutoku-mai, to the landholder (Satō 1967:248ff., Maeta, personal communication). It should be noted that before buying a parcel or accepting it as collateral on a loan, the prospective receiver surveyed and assessed it; the figures in the domain registers were never trusted.

35 This was common among large landholders; an 1825 Akino family document outlining investment practices fordfuture household heads enjoined against buying or accepting for collateral any parcel for which the tax owed amounted to over halfdthe possible rent (Kudō & Akino 1966:123-4). The differential in the attractiveness of paddy lands is illustrated in the contrast between Naka-kyōden and Kakuda-futakuchi Villages along the same branch canal of the Shōryūjigawa Main Canal. Naka-kyōden paddy lands had a high principal land tax rate of 56% and a total tax burden of 73.6% (of registered yield). It was hardly a desirable area for land purchases, and in 1804, outside owners accounted for just 30

Table 7

Distribution of Abe holdings in 1797

	Rent retained by Abe (koku)	Portion paid as taxes to domain (koku)	Number of tenants in village
Nakagawa Main Canal			
#13 Hirono Branch Canal			
Hirono-shinden	0	30.	11
#12 Oshikiri Branch Canal			
Sanbongi	164.4	9.6	39
Tsushima	38.0	11.6	12
Oshikiri	58.0	14.8	14
Fukuoka	16.8	1.2	1
Ōfuchi	19.6	1.2	1
#10 Yokoyama Branch Canal			
Yokoyama	2.8	0	2
Yokouchi	18.0	0	2
Tsutsumino	63.6	0	15
Doguchi	49.3	54.0	20
Hishinonuma	0.8	0.4	1
Shōshaku	21.2	5.7	5
#9 Wanagawa Branch Canal			
Wanagawa	22.9	0	3
#7 Yokogawa Branch Canal			
Yokogawa	47.2	14.1	14
#6 Gokamura Branch Canal			
Arayashiki	95.7	0	2
#4 Hosoya Branch Canal			
Osaeguchi	10.8	0	1
Shōryūjigawa Main Canal			
#26 Aoyama Branch Canal			
Aoyama	0.9	0	1
Tenshindō	48.0	0	26
Inoko	61.3	0	8
Narita-shinden	11.2	0	2
Inaba Main Canal			

Naganuma	17.0	4.1	6
Jūmonji	6.8	4.8	2
Ōyama River left bank			
4 villages	64.1	0	4
other villages (3)	16.9	0	3
TOTALS:	855.0 koku	151.5 koku	195 households

Note: These figures represent the amount of rice to be delivered by the tenants to Abe (hyōta-watari) and do not include the amount kept by the tenante

Source: OB 1974:134

Satō Shigerō's (1965) analysis of the Tōzō household suggests that at least in that case, tenancy was not as severe as the cycle of impoverishment that might lead to it would imply. Computing from Tōzō records, he discovered that rent (i.e., the landlord's portion plus the domain taxes) amounted to about 60% of actual harvest per unit of area ind the years, 1780-1800, but after that dropped to around 50%:

year	koku per actual 1 tan	rent	rent/yield
1780-1800	1.344 koku	0.809 koku	60.2%
1800-1830	2.238 koku	0.934 koku	41.7%
1830-1850	1.639 koku	0.821 koku	50.1%
1850-1870	1.758 koku	0.942 koku	53.6%

Source: Satō 1965:69, 71

Calculated differently, if we take his estimate that in the period, 1780-1800, paddy land in the Kakuda-futakuchi area actually produced 2.230 koku for every 1 registered koku (i.e., a parcel which had a registered yield of 1 koku would yield on the average 2.230 koku), this actual production figure of 2.230 koku was divided in the following proportions:

domain taxes	.494 koku	22%
landlord share	.627 koku	28%
tenant share	1.109 koku	50%

This second method of calculation provides further evidence of another characteristic of paddy lands in the downstream areas--the very low proportion of production that the domain was able to lay claim to. Only 22% of the actual production from Tōzō's tenanted lands was going to the domain, only slightly higher than the comparable figure of 15% for Abe's tenanted lands across the Aka River.

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koku of the village's 949 koku registered yield. It consequently had a very high proportion of abandoned land which had reverted to the village. Just downstream in Kakuda-futakuchi in 1807, 24% of the older, pre-1624 paddy lands (with a principal land tax rate of 44.8%) were owned by non-residents, while 78% of the village's new paddy lands (taxed at 20.8%) were registered to non-residents (Satō 1957:119).

Conclusions

Subsequent chapters will detail how peasant cultivators, domain officials, and large landholders were all involved in various irrigation tasks; at the same time, all three categories of persons were mutually engaged in matters of administration and land tenure. To what extent and in what ways these relations of domain administration and land tenure can be said to have determined patterns of irrigation organization is the crucial question in hypothesizing why the particular form of decentralized irrigation organization emerged in the basin during the domain period.

In working towards this, we must remember to distinguish between the original thrust of domain policy, which was never fully realized, and the later pattern of administration and tenure that resulted from then developments of the late 1600s and 1700s which have been sketched here. Early domain lord policy aimed to establish a politically secure and economically stable regieme by creating a countryside of demilitarized, landholding, and tax-paying peasant households, organized into self-regulating residential settlement units and administered by a hierarchy of officials recruited from among the warrior-retainers of the domain lord. Implicit in this order, then, was a tension between hierarchical control and self-regulating autonomy. It raised two possibilities for irrigation task performance: the village unit as a locus for water user mobilization and the exercise of authority by domain officials at the several levels of administration. At the same time, there were several features which qualified these possibilities: potential threats to village coordination posed by the village headmanship and the internal allocation of tax levies; the lack of congruence between administrative and hydrological boundaries; and an apparent lack of attention to irrigation by the domain hierarchy. That is, significantly, rice production and rice producers were rather carefully controlled by the domain from the standpoints of the production inputs of land and labor and of the production output (the rice) but there was seemingly little concern with the water input.

But whether this political-economic framework would have fostered water user autonomy or state-articulated elite control or some form of divided control is a moot issue because the Sakai lords were never wholly successful in imposing this order. As described in this chapter, they were prevented by the particular ways in which new paddy lands were opened up, production became commercialized, and land holdings fluctuated. These created a rather different social context for Aka River irrigation from the early 1700s on. The effectiveness of the village as a locus of water user mobilization was reduced as the congruence between residency, land ownership, and cultivation was disrupted. Domain officials had less cause to exercise authority in irrigation task performance as domain claims on agricultural production declined, particularly in the downstream new paddy lands. To be sure, large landholders, emerging in the 1700s, concentrated

their holdings in the newly developed downstream areas, which were the areas most susceptible to both water shortages and poor drainage. But their influence in and concern with irrigation affairs was diluted because these holdings were usually dispersed over a number of water course service areas and because they enjoyed considerable income from their lightly-taxed lands. These points will be further elaborated in subsequent chapters as we now turn to basin irrigation itself.

Chapter III

RICE CULTIVATION AND THE AKA RIVER BASIN ENVIRONMENT

As the administration and land tenture of the domain were central elements of the sociocultural context of Aka River irrigation, so too the drainage basin formed its natural environment. In describing that environment in this chapter, I will consider the hypothesis that irrigation organization in the basin attracted neither elite intervention nor peasant cultivator mobilization simply because the water supply was abundant and easily exploited or because water itself was not critical in agricultural production. In dismissing these possibilities, we will see that irrigation water served several essential though not easily quantifiable functions in Tokugawa rice cultivation, that there were a number of features of the basin environment that rendered water control highly problematical, and that estimates of supply and demand point to regular shortages appearing by at least 1750.

Water use in basin rice cultivation

Throughout the Tokugawa period (and indeed to the present day), irrigation in the Aka River basin served almost exclusively the cultivation of rice. Judging from surviving land registers, rice occupied 80-95% of the cultivated acreage in the basin, the remainder being vegetable gardens and small orchards. Water needs for these "dry field" (hatake) crops were generally satisfied by rainfall, although occasionally water from irrigation canals might have been applied. The gardens and orchards, however, did not have direct access to the canal networks, and it was rice that overwhelmingly defined irrigation water demand.[36]

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[36] The only other consumptive uses of irrigation water from the delivery canals were domestic uses and firefighting; each village maintained several small ponds in the settlement for fire-fighting use. Non-consumptive uses included washing, fishing, and curing wood. The rivers, though not the canals, served as transportation arteries. The other significant demand for Aka River water besides irrigation was in the castle town of Tsuruoka; water was used for various municipal uses and to replenish the castle moat. Aka River water was delivered to the

Rice grown in theebasin was largely non-glutinous paddy rice. There have been through much of history two cultivated species of rice, one grown exclusively in West Africa and the other common to the rest of the world. Within the latter species (Oryza sativa) are two groups of natural varieties, the indicas and the japonicas. The japonicas have always been the only group grown in Japan, although within the variety group there are a number of further distinctions. One is between upland rice or non-irrigated rice (rikutō) and paddy rice or irrigated rice (suitō)ę most japonica varieties are the latter type. There are also uruchi mai varieties, non-glutinous rice, and mochi mai varieties, or glutinous rice. A small amount of mochi mai was grown in the Aka River basin to make the rice cakes used for ceremonial and festive occasions (perhaps 2% of the total acreage to judge from several village planting reports to the domain), but uruchi mai was overwhelmingly cultivated.

More importantly, uruchi mai varieties were further distinguished by length of growing season. There were wase or early ripening varieties requiring about 80 days, chūte or medium ripening varieties requiring about 120 days, and okute or late ripening varieties requiring as much as 140 days.[37] Late ripening varieties, with the longest generative growth period, usually produce the highest yields, and so were the preferred varieties. However, cultivators of late ripening varieties in a northern area like Shōnai risked damage from late summer and autumn cold temperatures, wind, and rain. For this reason, domain authorities prohibited planting of late ripening varieties (e.g., YKS 1980:664-665); the ban was apparently widely ignored, and cultivators tended to mix early and late varieties according to their forecasts of the year's weather (Toyohara kenkyūkai 1978:530).

Application of water in japonica paddy rice cultivation is perhaps more complex than irrigation and drainage in any other cropping system. Small bunded field parcels are built and maintained to pond water around the rice plants, but in fact an optimal water strategy combines periods of standing water with periods of running water through the parcels and periods of draining and drying the parcels. This is done because in japonica cultivation, water is not only essential for direct cultigen growth (taken in by the plant and used in photosynthesis), but it also serves a whole range of additional functions in field preparation and plant growth. These include:

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castle town by the Shōryūjigawa Main Canal; by a proportional allocation formula discussed below, the town received about 15% of the master stream volume in times of low water.

[37] This is the period from transplanting to harvest. The period from germination to transplanting is roughly the same for all three (about 40-50 days in the domain period).

1. to prepare the soil for transplanting by wet tilling with large volumes of water;

2. to raise ground temperature and to protect the rice plant from extreme temperature damage;

3. to supply various nutrients to the plant and soil, including oxygen through ion exchange anddsuspended silt, renewing soil fertility;

4. to promote rooting and regulate stalk length;

5. to control weed growth, disease, and insect damage;

6. to swell the soil and thus promote oxygen release from the water;

7. to remove noxious gases and toxic elements;

8. to slow denitrification; and

9. to promote fixing of nitrogen by supporting blue-green algae.

It is this multi-functional role of water that greatly increases the elasticity of water demand and thus complicates computations of minimal water demand through the plant growth cycle. To appreciate the complexities of irrigation and drainage that Aka River basin cultivators faced, it is necessary to understand both the basic features of rice cultivation methods in the basin and the water demands of the rice plant through its life cycle. We can first summarize the general cultivation regieme followed by basin cultivators as follows.d[38]

1. composting and transport of compost to fields (koyashi hakobi or taihi biki). The primary fertilizer for paddy fields was compost, applied in the spring (as motogoe or negoe); after transplanting, a second fertilization (oigoe) was done with freshly-cut grasses (kari shiki). In advanced areas of the country such as Kinai, commercial fertilizers (principally dried fish and oil cakes) had become widespread by the mid-Tokugawa period, especially for cotton and other marketed dry-field crops. In Shōnai, too, by the 1830s, oil cakes and dried fish were purchased and applied, but this was not widespread. Composting was a year-round activity, using straw and manure from the horse stall, mixed with other straw and grasses, ashes, household manure, night soil collected from households in Tsuruoka, and mud from water channel beds. About March first, the compost was carried out to the fields by sled and

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[38] This brief portrait is compiled from several sources: OC 1975d:296-301; Toyohara kenkyūkai 1977:74-5, 1978:528-533; Iinuma & Horio 1976; Inami 1977; and Furushima 1967.

dumped in piles on a household's various plots. The sleds were pulled by the men over the snow because it was thought unhealthy to take the horses outside in the cold air of winter.

2. seed selection. Seeds were selected by visual inspection and by soaking in water. This was done about March 20th (at Higan, the vernal equinox). The seeds were then soaked in water for about 30 days. Germination followed about 6-10 days afterdremoval from soaking.

3. initial field preparation (takoshirae). Field work began in the last part of March, while the snow had not quite melted but after the soil began to soften. A first task was preparing the bunds (takuro kiri or kuromawashi). They were shaped, beaten and hardened with a mallet, breaks were repaired, and then they were plastered with fresh mud to improve water retention. This work lasted through mid-April.

4. seed bed preparation (naedoko koshirae). The seed beds were prepared for use in April. Apparently in Shōnai, they were only used in the spring and not as paddy fields in the growing season. They were fields of particularly good soil close to home because of the constant attention they required. Preparation procedures were the same as regular paddy fields although the seed beds were tilled more finely and were more heavily fertilized with compost. Aboutd May 1st, the sprouted seeds were scattered loosely (noppera maki) on top of the smooth and fine mud-soil more thickly than in the present day (about .8-1.0 shō per tsubo compared to .2-.3 shō per tsubo in recent times). The most important job after seeding was water management; the water level was continually adjusted for temperature and cloud cover. Standing water was also useful to prevent the birds from eating the new buds.

5. dry tilling (tauchi or kōki). There were two tilling phases: dry tilling broke up the ground and loosened the soil while wet tilling was a fine tilling done after water had been ponded on the field. Dry tilling was itself of three stages. In the first (arakoshi), a shovel-like nodachi was used to dig around the edges of the field next to the bund (a procedure known as kuro banashi); using this tool and a three-pronged hoe-like implement (the Bitchū kuwa), the soil was broken up, working towards the middle of the parcel. In a second stage (kama kiri), a long-handled sickle (nagae kama) was used to cut up the stalks from the previous year's crop. Then, using a kuwa, these stalks were further broken into smaller pieces (kokiri, kowari, or kotekiri). Finally, in saido, the large soild clods were broken up with the kuwa, fertilizer was spread about and worked in, etc.

6. wet tilling (shirokaki or takaki). Wet tilling began in the second week of May and required three or four weeks. It was necessary to start soon after water was let on to the field; otherwise the soil would solidify. The quantity of water was also important; too much or too little would prevent one from getting the soil to a fine texture (it would either remain too clumpy or become too compacted), which would in turn affect seedling rooting and fertilizer efficacy. The timing and quantity of water was particularly crucial in cold years, when the soil had to be provided sufficient air and heat. In wet tilling, also done in three stages, the horse was used to pull a toothed grader (manga or maguwa). The first time (ara shirokaki), a thick, long-toothed grader was used; thereafter, the second (naka shirokaki) and third (ue shirokaki) times, a thinner, short-toothed grader was used. The compost was carefully worked into the soil and the soil was worked to a fine, smooth consistency. Wet tilling required the largest volumes of water during the season; in the present day, for example, main canal intake volumes during wet tilling are about two and a half times the volumes during the mid-summer.

7. transplanting (taue or satsuki). Transplanting was done about 40-50 days after the nursery beds were seeded, about June 5th to 15th (traditionally begun on nyūbai, or the beginning of the monsoon rainy season, about June 11th, though there was no monsoon season in Shōnai). In Shōnai, transplanting was done randomly with about 20 plants per square meter; it was not until the turn of this century that straight-line planting with lines or frame was introduced. Sometime after, a second transplanting (niban ue) was done to replace plants which did not root and to fill in spaces missed. Soy beans or millet might then be planted on the bunds.

8. supplementary fertilizing (oigoe). Perhaps a week or so after transplanting, freshly-cut grasses were worked into the paddy soils with the feet. Alternatively, night soil, burned rice straw, and grasses were rolled by hand into balls and put into the soil between the stalks (sashigoe).

9. weeding (josō). Weeding was done 3-4 times in the 45 days following transplanting (in June, July, and early August). Weeds were either pulled by hand (kusatori) or a small hand cultivator (a kanitsume) was used for shallow inter-tillage (chūkō).

10. harvest (inekari). The rice harvest in domain period Shōnai began in late September in years of average weather through the growing season. The rice was cut by hand with a short-handled sickle (inekari kama), tied several plants to a bundle, and stood upside down on the field for a few days so the stalks might begin to dry. The bundles were then tied into larger sheaves which were piled on stakes that lined one side of the field. The rice was left to dry

on the stakes until about mid-October, when it was brought back to the house using human and horse labor (ineage or zaku seoi).

11. post-harvest processing (chōsei or hikeshi). Processing began in mid-October and continued into February. The rice was first threshed with a senba koki, a comb-like line of iron or wood teeth mounted on a frame. The unhulled grain (momi) was then spread out on the earth floor and beaten with a pestle so that no grains remained attached to the stalks. It was then winnowed by fan and unripe grains selected out with a karami. The grains were husked (momi-suri) with a baked earth mortar (kara usu or tsuchi usu) and winnowed again with a kome tōshi (or mangoku tōshi) to separate the husked rice from the chaff. The husked but unpolished rice (genmai) was then bagged in woven rice straw bags in 5 to (90 liter) volumes.

Despite the differences in growing season length, all varieties of the japonica group exhibited a similar growth cycle, each stage of which was associated with a different water demand pattern:

1. germination. The grains were germinated before sowing by soaking in tubs of water for about 30 days. Germination, marked by a tiny white spot appearing on the hull surface, followed 6-10 days after removal.

2. nursery seedling. The germinated seeds were broadcast on carefully prepared and levelled mud nursery beds, where they sprouted and grew for 25-50 days. A small volume of water, easily satisfied, was needed early in April to prepare the seed beds. Water was also needed in the month of May for the seeded beds; again the volume was small, though the application had to be precise and continually adjusted. Water temperature also had to be checked carefully.

3. transplanting and rerooting. After wet tilling the main paddy fields, water was left ponded for transplanting. The small rice seedlings were removed from the nursery bed and transplanted in the main paddy fields when the stalk length was about 10-15 cm. Because the root systems were damaged and cut in the transplanting, the seedlings had to reroot in the paddy field. The month following transplanting was a critical period of water application. The stalk was weak and the root system broken; the young plant could be blown over easily and cool temperatures were harmful. Thus, for a week after transplanting, deep water (c. 10 cm) was maintained to hasten rerooting and protect the seedling. By the second week, the level could be lowered. Shallow water during the day would raise the ground temperature, and in this period, higher temperatures were best for plant growth.

4. tillering. Tillering is the development of several stalks on the same plant. That is, buds at the base of the stalk develop and branch to form new stalks; thus, each grain sown will grow several stalks, and a panicle (head) of rice grains will grow on each stalk. Tillering began about 8 days after transplanting, as soon as the seedling had rerooted and continued for 1-2 months. However, beyond a certain point, tillering produces stalks which do not form panicles, and, then as now, cultivators tried to identify that point and prevent further tillering through water control and fertilizer application.

In its early stage, tillering was improved by a wide night-day ground temperature differential (30-35°C daytime to 15°C nighttime temperatures). Barring cold, cloudy days, then, shallow, standing water (3 cm) was favored during the day. In the evening, water was run through the paddy field, and deeper, standing water was maintained at night, which cooled the ground as well as insulated the plant against unseasonable cold air temperatures. By the late tillering stage, the cold temperature resistance of the plant was improved, and in mid-July, all water was drained from the field for several days.

This mid-season drainage period, variously known as nakaboshi, doyōboshi, etc., was long an important difference between east Asia irrigation techniques and the standing water methods of southeast Asia. A principal function was to halt tillering at the point where panicle-bearing stalks were no longer being produced. It came at the point in the life cycle when the plant shifted from vegetative to generative growth, and it aided this by preventing further inter-nodal elongation of the stalk (i.e., it stimulated the conversion from stalk growth to panicle formation).

The nakaboshi also replenished oxygen to the soil and roots and dried out the soil; this improved soil ventilation and encouraged the elongation of the root systems, which tended to remain shallow and close to the oxidizing surface layer. That is, paddy soils when submerged or water-logged were in a reduction state, except for the surface micro-layer. This was intensified by the decomposition of inorganic matter in the soil, such as the previous year's rice straw; with rising summer temperatures, this decomposed to supply valuable nutrients to the plants, but the decomposition also consumed needed oxygen and released toxic gases. The mid-seaon drainage was thus vital to lower soil layers and root systems in creating temporary oxydizing conditions.

This field drainage was continued for 7-10 days depending on the soil conditions--generally, until small cracks appeared in the soil (which improved soil ventilation) and walking on the field left slight footprints.

5. panicle formation. This was the critical stage when the spikelets flowered and the panicles (heads of grain) appeared. Rice spikelets contain only one flower, which has six stamendand an ovary. The ovary, after wind-pollinated fertilization, develops into the fruit, or grain; it is enclosed by modified leaves (the lemma and palea), which close up again after fertilization and become the hull or husk. The panicles are erect at blooming (flowering) but begin to nod as the grains develop and mature.dd

In an average year in Tokugawa period Shōnai, flowering in early ripening varieties was about mid-August; late-ripening varieties flowered about a week later. In years of less sunshine and cold temperatures, flowering could be delayed up to two weeks.

Water was important in the first three weeks of August both for the cultigen growth and because the young ears were quite susceptible to extreme high and low temperatures. Water application in this period was known as hana-mizu ("flower water"). Ideally, water flowing through the fields was preferred to standing water.

6. ripening. The weight of the grains increased for about 30 days following fertilization, depending on sunshine and temperature. There was a gradual reduction in water needs during this period. A final field drainage began by mid-September, as it was important both for harvest work and grain drying that the fields be as dry as possible. Determining the moment of harvest cutting was a delicate decision; there were small differences in the rate of grain growth, and it was necessary for maximum yield to judge when the maximum number of grains had reached but not passed full maturity.

Each stage of plant growth, then, required characteristic strategies of watering and drainage. Roughly, though, cultivators of the period compressed these stages into a distinction between shitsuke mizu ("planting water") and yashinai mizu ("nurture water"). The first referred to the large volumes of water applied from May through mid-June for wet tilling of the paddy fields and to the deep water that was maintained for transplanting and rerooting. The second, nurture water, covered the smaller but much more frequently manipulated volumes of water used in the summer months from mid-June through the end of August during the periods of tillering, panicle formation, and flowering. While remembering that this distinction glosses over much more complex watering practices, I will refer usually to this planting water/nurture water (or spring water/summer water) distinction in this monograph. Indeed, throughout the plant growth cycle, watering and draining demanded continuous attention and skilled judgment; it is no wonder thatd agricultural books of the period urged that they be entrusted only to the shitsukainin of the household--the person of greatest prudence and longest experience (Inami 1977:78).

The basin environment

Shōnai Plain is a small coastal plain about 50 kilometers long from north to south (see Map 2). The Mogami River bisects the plain roughly mid-way. South of the river, the plain is about 16 kilometers wide, east to west; north of the river, it is only about 6 kilometers. The plain is surrounded on three sides by mountains, and to the west, it is separated from the Japan Sea by a line of coastal sand dunes. Excluding these dunes, surface area of the plain is roughly 530 square kilometers. The plain is low-lying, largely between 3 meters and 15 meters above sea level. It was formed when the shallow lagoon behind a coastal sand bar was gradually built up with deposition from the several rivers flowing into it. At least by the seventh century, A.D., a low-lying, swampy plain had emerged (YKS 1968:112-119).

The Mogami River, which bisects the plain, is a long, extensive river system that passes through a number of inland mountain basins before entering the plain at Kiyogawa (elevation 20 meters). Until quite recently, it traced a wide and meandering course across the plain to the Japan Sea. Throughout the Tokugawa period, its width and heavy discharge prevented the control necessary to exploit the river for irrigation and brought periodic flooding to the land on either side of its channel. Instead, it was the smaller river systems that drop to the plain in the north and south for short runs to the sea which were developed as water sources.

In the Tokugawa period, it was possible to distinguish four separate river networks on the plain (Map 5). North of the Mogami River were the Gekkō River, the Nikkō-Arase Rivers, and the Aizawa River. This northern half of the plain is dominated by the volcanic cone, Mt. Chokai (2230 meters). Dissection of its ash apron created a labyrinthine valley pattern that somewhat diluted the basin character of the northern plain; the rivers north of the Mogami tended to run west in parallel courses to the Japan Sea.

The southern half of the plain displayed much more of a true basin character. The surrounding mountains, diluvial uplands, and coastal dunes caused the rivers to flow together at the center, forming a single drainage system, the Aka River basin, named for the largest in-flowing river (see Map 3 and Figure 1). As Table 8 indicates, the total drainage basin area was approximately 1126 square kilometers, of which almost three quarters was the mountainous upper basin. As mentioned in chapter one, the basin could be subdivided hydrologically into what I shall call the master stream drainage basin (that is, the Aka River proper), and two tributary stream systems, the Kyōden River system to the east and the Ōyama River system to the west. Both the Ōyama and Kyōden Rivers and the streams feeding into them were quite small in discharge. There were, in Tokugawa times, several small canals constructed along and drawing water from upstream sections of both systems but they served only minimal acreages.

Figure 1: Schematic drawing of master stream and principal tributary networks

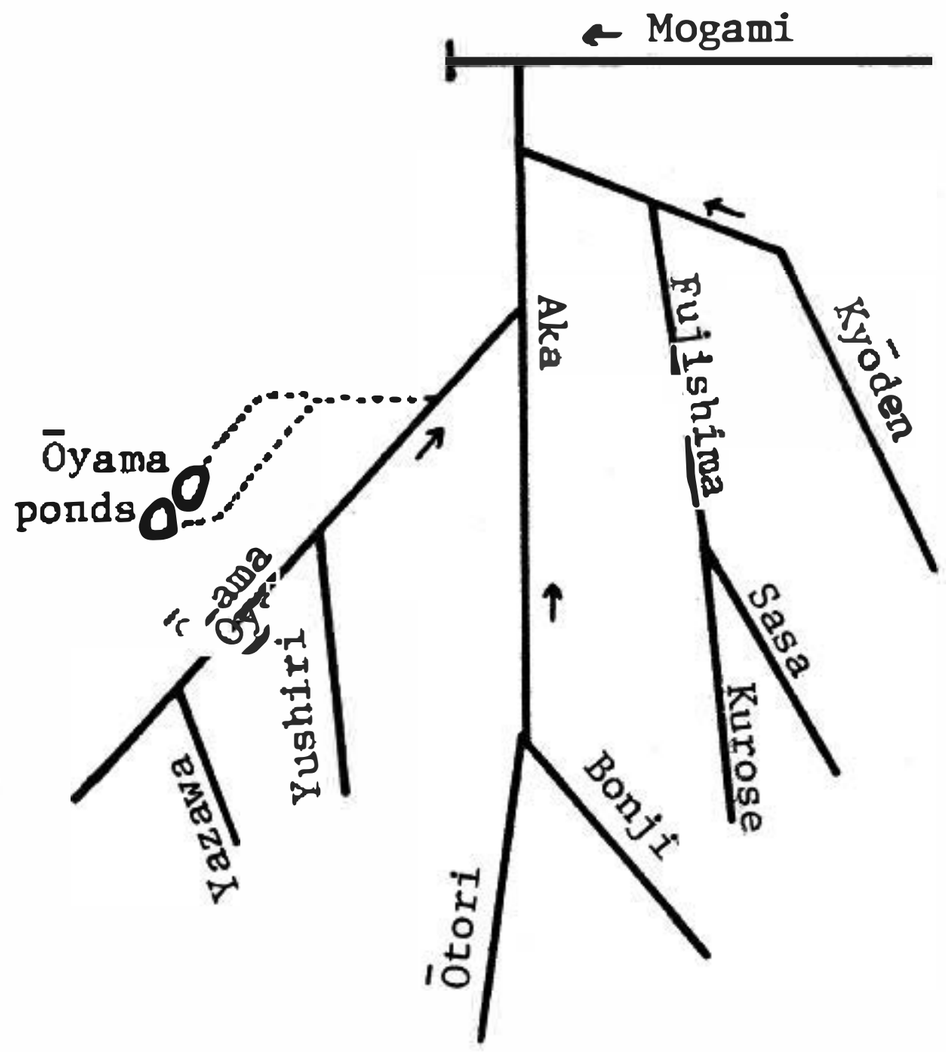


Table 8

Watersheds and stream lengths in the Aka River drainage basin

	stream length	area in mountain	area on plain	total watershed area
(master stream)				
Otori-Aka River	78 km	609 sq km	117 sq km	728 sq km
Bonji River	30			
(Ōyama tributary)				
Yushiri R, Hishizu R, Yazawa R → Ōyama R	25	86	76	162
(Kyōden tributary)				
Kurose R, Sasa R, Kyōden R → Fujishima R	40	109	127	236
	36			
TOTAL	179 km*	804 sq km	320 sq km	1126 sq km

*Total stream length exceeds 300 km with smaller tributaries

Source: MAF 1959:7, 733

The landform of the Aka River master stream system is composed of three sections: the mountainous upper reaches, an alluvial fan mid-section, and a broad, downstream deltaic plain. Figure 2 is a channel profile of the master stream. The Bonji and Otori Rivers drop fairly steeply at a 1/45 grade through the mountainous upper reaches, flowing together at Ochiai (elevation 77 meters). The scouring actions of these headwaters and the high discharge in the spring following the snow melt can give the river a heavy sediment load, and from Ochiai, where the plain begins, the rather sudden loss of grade and wider flatland combine to rapidly reduce river velocity. This has resulted in the deposition of much of the heavier sediment load (the gravels and other coarse particles) at this point, forming over time an alluvial fan (cf. Bull 1977).

Alluvial fan topography and river systems are common in Japan--geomorphologists count up to 800 of them (Koide 1974:44 ff.)-- and they have several important implications for irrigation. As the Aka River built up more of a fan-shaped slope with successive sedimentation, its

natural channel was destabilized. The river was always stable as far downriver as Ochiai and Kumaide. But prior to the 1605 embankment project at Kumaide, it had flowed off the fan and across the plain in several different channels, shifting abruptly from one to another at times of unusually high discharge (OA 1974, Koide 1975)e

Thus, a precondition of irrigation in such alluvial fan topography is the source control problem of stabilizing the river to prevent channel shifting. At the same time, if channel stabilization is successful, the grade of the alluvial fan will allow for gravity-flow canals taking off near the top of the fan and delivering water to fields throughout the downstream plain. Indeed, in the Aka River basin, excepting two small canals which had intakes farther up along the Bonji River, all master stream canals began close together along the alluvial fan. Moreover, the historical pattern of multiple river channels meant that lengths of these older natural channels could be modified and used as the main canals of these irrigation-drainage networks.

The third landform section of the master stream drainage basin is the flat, low-lying deltaic plain, which begins where the alluvial fan levels off, roughly around the castle town of Tsuruoka. The river grade here ranged from 1/1000 to 1/3000 for its 20 kilometer run to the mouth of the Mogami River. Paddy land in this area was around 2-10 meters above sea level, and until the early 1600s, this part of the basin, like the entire central portion of Shōnai Plain, was a wet marshland of reeds and swamp grasses.

The master stream in the alluvial fan section is the water source for the canal networks; in this downstream section, it serves a critical drainage function, receiving the discharge from the canal networks (which drain the paddy fields as well as supply them with water)e Because of the flat grade, natural drainage is quite poor, and in the long course of river training projects, improving downriver drainage efficiency and capacity has demanded as much attention as improving upriver source controle Of special concern to irrigators living in this downriver section was the frequent flooding around the confluence of the Aka River with the Ōyama River tributary. This perennial problem was caused by the backing up of the river where it met the coastal dunes and was forced to turn ninety degrees north and follow the dunes to the Mogami River.

The Aka River in the domain period was unstable and unpredictable not only because of its shifting channel pattern but also because of its variable river regieme. A river hydrograph (a graph of time variation of river flow), constructed from recent years' data, shows that the Aka River has a primary peak flow in April and May (due to the spring melt of snow in the upper basin), a secondary peak in November and December (due to late autumn rainfall), and two troughs of low water--during the mid-winter months of January and February and a more severe trough during the mid-summer months, bottoming in August (see Figure 3, Table 9 and Table 10)e

Figure 2: Channel profile of the Aka River master stream

Source: MAF 1959

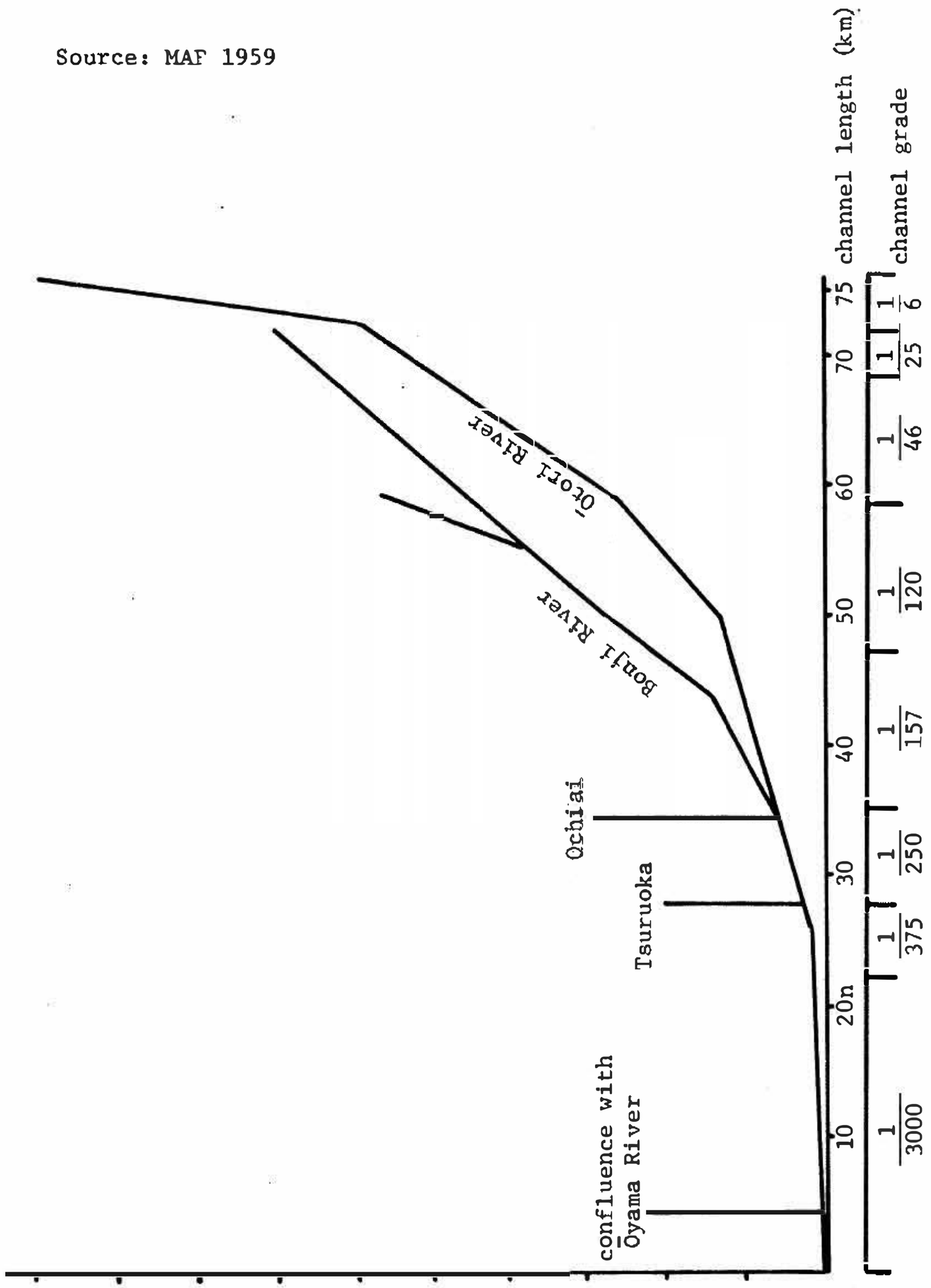
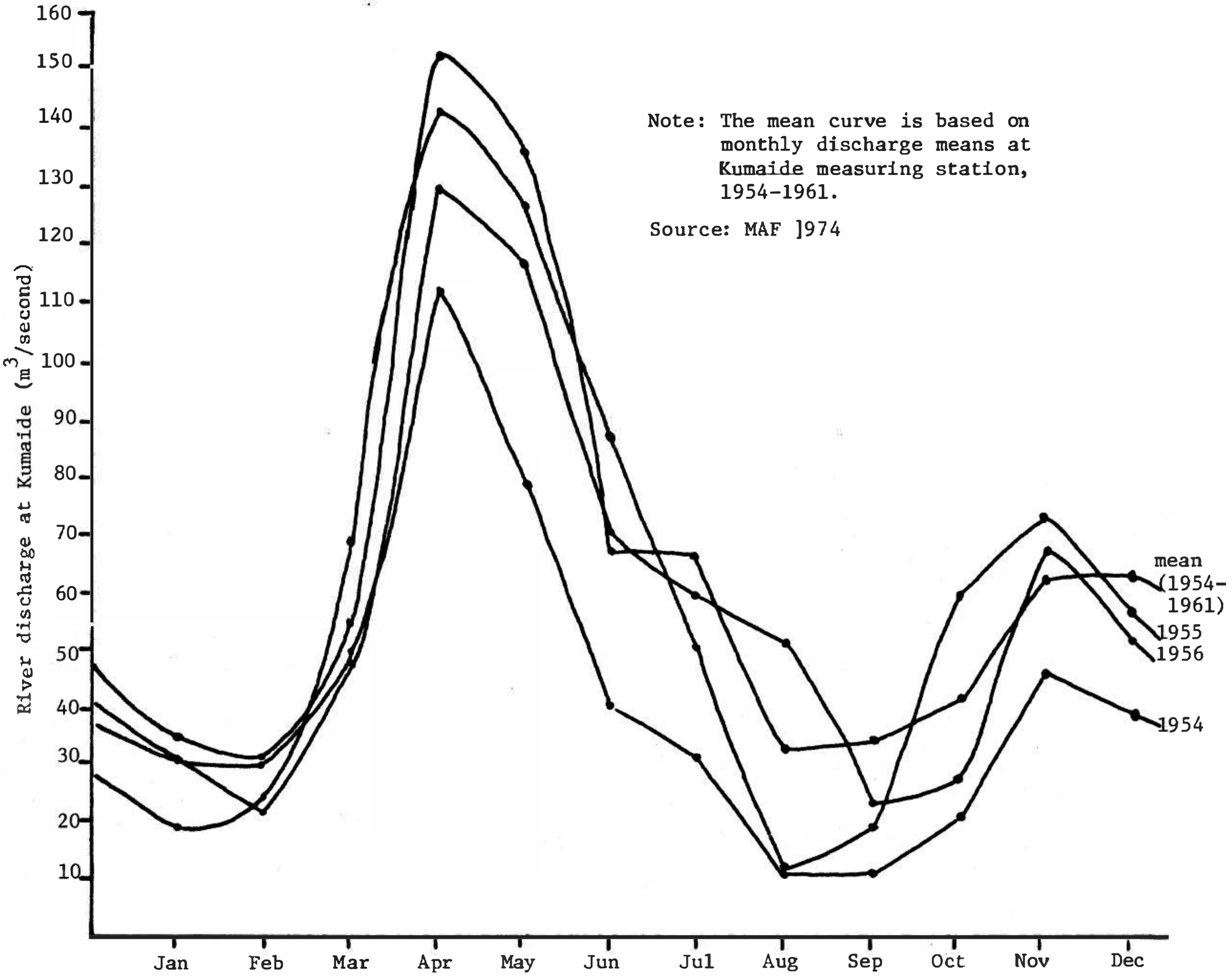


Figure 3: Hydrograph of the Aka River at Kumaide



Note: The mean curve is based on monthly discharge means at Kumaide measuring station, 1954-1961.

Source: MAF]974

Table 9 Monthly mean discharge of Aka River at Kumaide

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1954	31.24	31.38	48.57	113.52	78.72	40.50	31.49	12.88	12.77	20.09	50.90	38.02
1955	18.99	24.34	68.29	143.75	127.94	86.59	49.19	11.85	18.66	59.19	72.86	56.33
1956	30.44	23.01	49.97	129.54	116.59	69.28	58.24	50.22	22.88	27.29	67.89	52.44
1957	26.03	28.02	16.99	195.74	229.81	96.55	87.53	29.43	38.06	43.67	52.02	52.52
1958	46.8	36.9	53.1	172.6	119.9	54.3	89.7	54.8	65.7	70.4	66.6	82.1
1959	43.1	50.3	8910	154.8	85.0	47.5	84.2	36.4	49.2	42.8	58.7	66.4
1960	42.9	39.9	66.4	152.2	148.1	64.3	51.0	25.8	19.5	29.8	32.9	81.7
1961	35.1	22.1	37.9	160.5	178.5	81.3	86.8	42.6	44.6	41.3	99.5	71.8
mean	34.33	31.99	53.78	152.83	135.57	67.54	67.27	33.00	33.92	41.82	62.67	62.66

All values in m^3/second

Source: MAF 1974:57

Table 10

Flow characteristics of the Aka River at Kumaide, 1954-1961

	maximum discharge	normal discharge	low water discharge	drought discharge	lowest discharge
1954	208.9	26.38	12.38	6.34	5.59
1955	574.1	44.71	18.56	7.58	3.89
1956	284.3	39.47	26.39	14.57	11.05
1957	696.7	45.10	28.51	12.29	9.25
1958	601.6	57.75	41.66	28.65	21.49
1959	369.6	55.35	39.55	22.47	16.19
1960	298.1	48.62	31.29	14.76	13.52
1961	420.0	50.90	36.60	21.19	9.25
MEAN	432.0	46.04	29.37	15.98	11.28

Note: All values are in cubic meters per second.

Although this hydrograph is based on recent readings, I believe it broadly suggests flow characteristics for the domain period as well. In attempting to quantify river volume and variability in previous centuries, however, one encounters serious problems of evidence. An exhaustive search has uncovered no early long runs of water discharge values, even for the irrigation season only. Data since 1957 are of limited use because recent construction of two large headwaters dams has greatly affected river discharge values. There are some scattered readings in the years 1930-1950 for those times in the summer months when river levels remained low long enough to require a special allocation among the main canals; the mean measured discharge for eight such readings was 13.05 cubic meters/second (S/S 1968:336-368). And, a 1954 study of Aka River irrigation cited figures from the basin irrigation cooperative office of a "mean flow" for the two-month interval of May-June of 89.3 cunm/sec and for the subsequent interval of July-August of 17.6 cunm/sec (Shirakawa 1954:26-27). These are admittedly inadequate bits of evidence, but I have tentatively accepted them in estimating that in the Tokugawa centuries, the mean river discharge for July-August was on the order of 17.6 cunm/sec and that there was considerable variation around this mean, both within the two-month interval and annually.

I am also estimating that the mean discharge for the two-month interval of May-June (corresponding to field preparation and transplanting) was on the order of 90 cunm/sec, again with considerable variation. Rather than an absolute shortage of water, the more usual danger in these months was damage to irrigation works of high discharges and flooding; where

facilities were damaged, flow was disrupted, and as it was a time of maximum demand and peak labor needs, shortages could and did develop. Again, though, it is difficult to quantify the flood volumes and frequency. The figure for bankfull stage (the incipient flood stage of the river) used by engineers in planning the dams in the 1950s was 2200 cu m/sec; given the extensive embankment works constructed in the alluvial fan section in this century, the domain period figure must have been much lower--and thus much more often exceeded. Records of domain period flooding will be discussed in chapter four, but it has been impossible to calculate a mean annual flood value (Leopold et al. 1964:63-66) or a coefficient of river regieme (kajō keisū). However all indications are of a highly unstable and variable flow in the Aka River.

Soil

As an alluvial and aggradational plain, the parent material of Shōnai soil has come from the surrounding mountains--material scoured, carried down, and deposited by the rivers. In the Aka River basin, river flow and topography have combined to produce two distinct soil problems for cultivators. The larger sand and gravel particles dropped early from the river's sediment load to form the light soils of the alluvial fan. Lacking a thick clay topsoil, these soils were very permeable, with water percolation rates of 35-66 mm/24 hours when recently measured (MAF 1974).

Finer-grained sediment was carried farther downriver to form the clays and loams of the downriver plain (roughly, those fields below 15 meters elevation, about three-quarters of basin arable acreage). Here, the flat topography, lack of river control, and high water table waterlogged these potentially productive, dense clay loams to create permanently gley soils (soils in a constant reductive state), with little percolation (12-18 mm/24 hrs.)ee[39]

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[39] Soil is either in a state of oxidation or reduction, depending on the availability of oxygen. In oxidized state soils, aerobes are active while anaerobes are dormant; iron is oxidized, and the Fe+3 gives a brown or yellow-red color to the soil. In reductive layers, anaerobes, which are dormant when exposed to air or untra-violet light, become active; iron in the reduce Fe+2 state gives a blue or blue-gray color to the soil. The optimum condition in paddy soils is an alternation between oxidized and reduced soil states.

Soil under standing water or permanently below the water table may be in a constant reductive state. Such soil, termed gley, is very unproductive because lack of oxygen means there is little breakdown of organic soil material to supply nutrients to crops and inadequate oxygen supply for crop root systemse This is not to say that rice

Climate

The Aka River basin has a temperate zone climate with distinct seasonal variation (Table 11). Tsuruoka is located at latitude 38°43' N, roughly on a line with Washington, D.C., and Sacramento. Twentieth century temperatures produce a winter severe enough to limit rice cultivation to a single annual crop between mid-April and mid-October. There is an average of 190-210 frost-free days on the plain, and a continuous snow cover averaging 74 days (MAF 1974:54).

It must be emphasized that as with most other aspects of the natural environment, our climatological data are restricted to the present century. It is only with considerable caution that inferences may be drawn about domain period climate. While the basic pattern of temperate zone seasonal variation without a summer monsoon was constant, it is well documented tht the centuries of 1550-1850 were a period of low mean temperature and early winters across much of the northern hemisphere (compared to temperatures in the centuries preceding and following). This period is in fact known as the "Little Ice Age" (see Lamb 1972:chapters 17, 18; Le Roy Ladurie 1971; Arakawa 1957). This would have meant for Tokugawa period Shōnai a shorter growing season and cooler summer temperatures (though not necessarily more precipitation) than have prevailed in the present century. It is thus probable that twentieth century data understate the climatic restraints on domain period rice cultivation.

The precipitation pattern in the drainage basin had varied consequences for irrigation and rice cultivation. Rainfall was moderate to heavy in the fall (October-November), which proved troublesome for drying fields for harvest operations and for field-drying the cut sheaves before threshing. The heavy winter snowfall was stored naturally in the upper basin; its release as the spring melt was of critical value to spring planting, but there was no year-round cover and the melt ran off quickly. In mean totals, summer precipitation in recent decades has been moderate, suggesting an important source of mid-summer water needs. On closer inspection, however, summer rainfall has been highly variable and

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cultivation is impossible in gley soils. Even under standing water, the surface soil (a few millimeters to a centimeter) will be oxidized through ion exchange with oxygen in the water. There can be oxidation layers below this as well, baseddon the principle that water passing down between two soil particles will release dissolved oxygen as it comes out below because of the pressure change. Even in gley soils where the water table is high and drainage poor, careful construction of paddy soil, e.g., micro-layering, can bring about enough oxygen release around roots to cultivate rice. However, yields in such soils are low and unstable, and the cultivation work itself difficult. These soil conditions obtained in much of the basin until quite recently.

Table 11

Climatological features of the lower Aka River basin

	mean daily temperature (°C)	highest daily temp (°C)	lowest daily temp (°C)	hrs. of sunshine	precipitation (millimeters)
Jan	0.6	3.7	-2.3	56.0	214
Feb	0.8	5.0	-2.6	83.2	123
Mar	3.5	7.5	-0.6	104.8	116
Apr	10.2	15.4	4.9	158.4	121
May	15.7	21.3	10.0	186.8	113
Jun	19.3	23.7	14.7	172.0	124
Jul	23.6	27.7	19.4	163.7	242
Aug	25.2	29.7	20.6	221.4	202
Sep	20.8	25.3	16.3	163.4	231
Oct	14.3	19.0	9.7	138.2	215
Nov	8.9	13.1	4.6	77.8	297
Dec	3.6	6.8	0.4	39.7	280
year	12.2	16.5	7.9	1565.4	2278

Note: All measurements taken at the Tsuruoka measuring station. Values are mean values for the years 1944-1976.

Source: Nōrinshō 1945-1977.

concentrated in short, intense rainstorms that bring little usable precipitation to cultivators. For example, readings from 1945 to 1954 show that an average of 40% of August's total precipitation fell in a single 24-hour period (Kelly 1980:75).[40]

As a consequence of this pattern of concentrated rainfall and wide, annual fluctuations, there are often extended periods of dry weather in the summer months. Records of "dry weather" (kanten; a period of at least seven days with less than five millimeters total precipitation) from the Tsuruoka station from 1927 to 1962 show that the mean longest dry weather spell in a single year was 20.42 days. This ranged from 9 days in 1934 to 54 days in 1943. The mean total of summer dry spells was nearly 60 days per summer, ranging from 37 days in the summer of 1935 to 92 days in 1943, virtually the entire summer (MAF 1974:72-3, 76).

Another feature of the basin climate worrisome to cultivators was the low minimum temperatures in the summer, which could and did have a pronounced adverse effect on rice plant growth.

> For rice culture in the northern part of Japan low temperature is the most important climatic factor. Continuous low temperature throughout the vegetative growth period causes the delay of heading and results in a dramatic reduction in yield. But the effects of a short period of low temperature at the emergence or transplanting, as well as during the period from young panicle formation to flowering, are remarkable. (Hanyu 1974:84)a

Extension service agents in Shōnai presently consider the following temperatures to represent the danger levels below which plant growth is retarded in the basin (Onuma Wataru, personal communication)e

rooting	=	12.5 - 15.5ĕC
tillering to flowering	=	18ĕC
ripening	=	20ĕC

Table 11 indicates that while daily highs approach 30ĕC in August, the hottest month, daily lows do not average much above 20ĕC, the minimum temperature for ripening rice. Similarly, daily lows in late June and

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[40] Not only did this pattern of concentrated rainfall limit the utility of summer precipitation for irrigation, but such storms caused much damage to irrigation facilities and paddy fields. Of the thirteen most serious recorded floods in the Tokugawa period, nine occurred in the summer months and seem to have been the discharge of just such sudden storms. Teppō mizu, "rifle water,ë was the term used to describe the first crest of flood water in the swollen river, pouring out of the mountains.

early July hover around what is presentlyethought to be necessary minimum temperatures for healthy tillering and panicle formation. While these temperature danger levels are for present-day varieties, we will see that a frequent cause of harvest failure in the Tokugawa centuries was thought to be periods of low temperatures during the growing season. This indicates that basin irrigation had a vital role as a means of ground temperature maintenance and insulatione

Calculatingea supply-demand balance

We can see from this brief portrait that the basin environment posed problems in all four phases of irrigation. Source control required river control, and features of the topography and precipitation pattern presented intractable challenges. The river, destabilized by the alluvial fan topography, was disposed to run off the fan in a number of channels, though the alluvial fan landform itself acted to localize the source control problem; if the river reach around Kumaide could be stabilized, the master stream could become a major irrigation source. The steep grade of the upper basin, the spring snow melt, and the sudden, unpredictable summer storms combined to present major high water problems while the minimal summer precipitation apart from the brief storms caused extremely low river discharges for much of the summer months. The low river discharge required weir construction, which was then threatened by the flood discharges following storms.

The alluvial fan favored water delivery through dendritic, multi-level networks from the fan on both sides of the master stream. The numerous channels traced by the master stream in the past could be, and were, modified into main delivery canals without large investments of labor and materials. The flattening out of the river in its downstream reach discouraged intakes below the alluvial fan (as in settling Narita-shinden, they were occasionally attempted but failed)e

Water was used in the basin almost exclusively for rice cultivation, and characteristics of the rice plant and of the paddy field had several effects on the strategy and volume of use. Water served a variety of functions through the growing season, supplying nutrients to plant and soil, renewing soil fertility, protecting the plant against temperature, wind, disease, and insect damage, and so on. This not only required a judicious strategy of continuous adjustments in paddy field water levels, but also, as a consequence, made it very difficult to determine a minimally adequate water volume. The multi-purpose nature of water left considerable room for disagreement in allocation disputes. This was compounded by the wide variation in water percolation rates between upstream and downstream soils; all else equal, water permeated upstream soils two to three times faster than downstream soils.e The upstream areas thus could have a much higher consumption of water. Finally, the critical

need for water following transplanting and around flowering intensified disputes at those times.

The nature of rice cultivation makes drainage a problem of equal rank to delivery, affecting both plant growth and long-term soil fertility. Drainage was quite adequate in the upstream area (too good perhaps), but in the flat, low-lying downriver plain area, the clay loam soil was compacted and water-logged much, if not all, of the year. This was not simply a matter of local field drainage but was related to the sluggish and flat master stream and tributaries, all of which were trunk drainage canals for the master stream basin.

Taken together, characteristics of the Aka River basin environment would appear to have favored technical solutions involving a basin-wide integration of the physical system. Control of the master stream as water source and of the master stream and tributaries as drainage channels was absolutely critical to satisfying water needs, assuring stable yields, and maximizing expansion of paddy lands throughout the basin. A piecemeald approach could prove dangerous; improvements in upstream source control, for example, would only increase river velocity, which in turn would exacerbate downstream drainage problems. And, by the nature of the three large canal networks,dirrigators in those service areas were faced with both upstream flood control and delivery problems and downstream poor drainage conditions.d In this sense, basin irrigators were implicated together in source control, delivery, use, and drainage problems by the basin topography, precipitation pattern, stream flow, etc. The situation would appear to have called for an integrated organizational approach to the tasks of irrigation. That extensive, centralized organization, either articulated to the domain or autonomously developed by the water users themselves, did not emerge is thus all the more striking and problematical.

Or was it not surprising? Was there such a surplus of water supply over demand that a decentralized and unorganized approach to irrigation tasks could be tolerated? Drawing up a supply-demand balance involves at least three precarious estimates. First, there is supply; figures were introduced for river discharge at Kumaide (that is, river water available to the main canal intakes) of 89.3 cubic meters per second (mean value for the two-month interval of May-June; higher in May and lower in June) and 17.6 cudm/sec (mean value for the two-month interval of July-August). Averaged into the July-August mean are the flood discharges from brief storms so usable discharge is actually lower by an undetermined degree. Moreover, supply was not only seasonably variable but also fluctuated from year to year; it was estimated that with a mean frequency of one in every two years, discharge dropped below 15 cudm/sec for periods long enough to have caused inter-main canal disputes in the present century.

Second, there is demand per unit area, the duty of water. Given the multiple uses of water in rice cultivation and soil variations in the

basin, it is impossible to determine precisely demand values for the Tokugawa period. It is also difficult to infer these values from present duties of water because of substantial changes in rice varieties and growing techniques. There have been essentially two shifts in cultivation practices since the domain period.d Around the turn of the century, there was an introduction of horse-drawn plowing together with a gradual adoption of purchased fertilizers (dried fish cakes, oil cakes, and others), rectangularization of fields, and changes in germination techniques, seed bed preparation, and transplanting methods. This pattern continued until the 1960s, when changes such as mechanization, increased chemical fertilizer/pesticide use, and another redesign of paddy fields have brought a second complete reform of cultivation practices.

There was, however, in the period of roughly 1900-1960, a figure for average duty of water in basin paddy fields developed by the Aka River Irrigation Cooperative for use in allocations during the summer months among the main canals (Shirakawa 1954:27). This was 0.023 cu m/sec/10 ha, and apparently represented a minimal demand volume during the period from transplanting to ripening (June through August). We know too that the accepted estimate of the water demand differential between the pre-horse plowing cultivation pattern of the Tokugawa period and the post-1900 pattern was on the order of 1.4--that is, the newer techniques required on the average during the season 1.4 times the previous water volume (see the 1897 report for the Aka River Irrigation Cooperative by the engineer Nagao in S/S 1968:170-181, especially page 177). If these figures are used, they yield a value of 0.016 cubic meters per second per 10 hectares as an average minimal water demand rate for Tokugawa period cultivation practices. It is not a figure that can be used with much confidence, but it represents the best estimate we have.

Third, total water demand for the basin acreage must be calculated. I have been able to compute reasonably accurate service area acreage figures for the end of the domain period (1870) but can only develop gross estimates of acreage earlier in the period by inferring from the pace and extent of paddy land expansion (these inferences are detailed in chapters 5 and 6). In 1870, total acreage served by the nine alluvial fan intake main canals was about 9,430 ha; in 1750, it is estimated to have been on the order of 8,000 ha, and in 1650, roughly 5,000 ha.

Using the above supply and demand values, the following estimates obtain:

	c.1650	c.1750	c.1870
acreage served:	5000 ha	8000 ha	9430 ha
duty of water: (June-Aug. mean)	.016 cudm/ sec/10 ha	.016 cudm/ sec/10 ha	.016 cudm/ sec/10 ha
total demand: (June-Aug. mean)	8.0 cudm/sec	12.8 cudm/sec	15.0 cudm/sec
river volume: (May-June)	89.3 cudm/sec	89.3 cudm/sec	89.3 cudm/sec
river volume: (July-Aug.)	17.6 cudm/sec	17.6 cudm/sec	17.6 cudm/sec

These estimates indicate that throughout the domain period, the mean river discharge in May and June was more than enough to satisfy water needs; problems in these months included the disruption of delivery due to damage to irrigation works by high discharge and shortages in mid- to late-June after the snow melt and when the mean discharge was falling to July-August levels.

By July and August, the margin of supply over demand was much smaller; in fact, there are two additional factors to be considered that further reduced the margin: in-transit losses (such as evaporation and seepage in delivery canals) and non-irrigation demandsd I have chosen to use a 10% in-transit loss value based on measurements several decades ago along the still unlined canals (see Shirakawa 1954); this is a very conservative estimate, and losses even in recent years have run as high as 25%-30%. The only non-irrigation use of the river water in the alluvial fan section was an allocation to the castle town of Tsuruoka for municipal and domestic uses and for castle moat maintenance. This was delivered by means of a branch of the Shōryūjigawa Main Canal and amounted to approximately 15% of the river discharge.

In-transit losses and the Tsuruoka town allotment thus amounted to at least 25% or 4.4 cudm/sec of the river discharge, reducing the available supply to paddy fields to 13.2 cudm/sec. This is 1.9 cudm/sec below the 1870 demand figure and only fractionally above the estimateddd1750 demand figure. It is still well above estimated demand in 1650.

Figures once produced have a way of gathering an aura of authority, and it must be remembered that these figures rest uneasily on informed but highly speculative inferences. Still, if they even roughly approximate the domain period conditions, they suggest that by at least 1750, water demand was approaching available supply. Given the annual fluctuations and given any departure from 'equal' allocation, one may expect that by the mid-1700s shortages would not have been uncommon. They suggest, then, that expansion of the service areas through development of new paddy land

in the first 150 years of the domain period made water supply relative to demand increasingly tight in the last 120 years of the period. It cannot be for lack of supply-demand imbalances nor for lack of irrigation problems posed by the natural environment that strong elite control or effective water user organization did not emerge throughout the domain period.

Chapter IV

MANAGEMENT OF THE RIVER

We have seen in the previous chapter that irrigators using the Aka River had to contend with highly variable discharge volumes that could bring both flooding and drought within a single irrigation season. Sudden spring thaws and mid-summer rain storms could swell the river above 3500 cudm/sec and quickly overflow channel banks, damaging irrigation intakes, canals, and paddy fields (as well as threatening life and property in villages and castle town). Moreover, field drainage back through the canal networks and into the master stream and tributaries frequently threatened the low-lying downstream plain with inundation. On the other hand, the steep grade in the headwaters and the normal summer precipitation patterns reduced river flow by August at the critical time of rice plant flowering to perhaps 15-20 cudm/sec.

Inaba's embankment construction and channel diversion project in 1605-6 did provide a modicum of stability for the river course in the alluvial fan, but it did little to moderate the variable flow. After that, throughout the domain period, there were only very modest efforts to further control the river. There was repeated flood damage, downstream drainage problems, and water shortages within the delivery networks. The few river projects of the period were usually handled through the domain administration. Yet despite the modest efforts and continued problems, there is little surviving evidence of either debilitating conflict or water user organization at the river level. This chapter examines these points in some detail.

Domain officials could and did exercise jurisdiction over the major rivers in Shōnai, including the Aka River. While particular projects might on occasion be assigned to a special officer, general river matters were administered through the rural magistrates (gun-bugyō). The headwaters and alluvial fan secion of the Aka River basin fell within Kishibiki District; in the downstream section, the east bank lands were part of Nakagawa District while the west bank lands lay within Kyōden District. Because there was one magistrate post for every two districts, there were thus two magistrates, the Kushibiki-Nakagawa magistrate and the Kyōden-Yamahama magistrate, with jurisdictional responsibility along the master stream.

River repairs and projects, like all rural civil construction, were formally initiated by local petition from villages through the village group headman (ōjoya) to the rural magistrate--for example, by headmen of villages in an area that had suffered damage from breached river embankments. Each rural magistrate had under him several officials for project estimates and supervision. Upon receipt of a petition, an initial survey was made by an assessor (wariyaku), who would draw up a plan, estimate costs and labor, and propose labor quotas (i.e., how many laborers from which areas). These plans were then checked by a general assistant to the magistrate (shitayaku)e If estimated labor was below 1000 laborer-days, construction could be authorized by the assistant; if the estimate exceeded 1000 laborer-days, it was necessary for the rural magistrate to survey the site personally. For a particularly costly project, approval by the council of elders might be necessary.

The general assistant then supervised the approved project, aided by surveyors (ōtsuetsuki and kotsuetsuki) and materials procurement officers (kishiba shoharai yaku). These latter two roles (and that of wariyaku) were seasonal and filled by peasants in each district; they were paid with a small rice allowance by the district deputy, for which the villages of the district were assessed.[41]

River repairs and projects were one form of gō-fushin, a term which referred to all civil construction outside of the towns that was underwritten by the domaine This included irrigation facilities, bridges, and roads as well as river repairs. Such projects were financed by a fixed annual levy on all villages in the domain, amounting to 3.5% of assessed village yield (muradaka). It was payable in rice and collected as part of the general tax payment (one of the miscellaneous taxes; see chapter 2). Two-thirds of this total gō-fushin tax (known as sadame-mai and san-ka-ichi-mai) were alloted to the rural magistrates and the remaining one-third (called go-fushin-mai) to the domain rural affairs officers (gundai). The budget for the domain rural affairs officers would allow them to subsidize particularly expensive repairs or projects that a single rural magistrate could not cover with his budget. If the rural affairs officers did not use their full allotment in the course of the year, the balance could be released to the rural magistrates (YKS 1961b:266). It has been estimated by Satō and Shimura (S/S 1966:8) that the annual expenditure for Aka River projects was about 1700 koku; I would hazard the supposition that much of this amount was expended for flood damage repairs to the Shōryūjigawa intake and to the alluvial fan section

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[41] This section is based on the document, "Stipulations for Civil Construction and Requisitioning of Men and Animals in the Rural Areas of the Domain," (Gō-gofushin narabi gō-kata jinma-wari sadame-kaki), circulated in 1730 by the domain rural affairs officer through the rural magistrates to the villages of the domain (YKS 1961b:266-67; YKS 1980:103-105).

embankments.

Labor services were also requisitioned for domain public works projects; if called upon for a project by the rural magistrate within whose district it lay, a village was required to provide up to seven corvee workers per 100 koku of assessed village yield. A small daily wage was paid to those above that number. Although labor was drawn generally from the area that would benefit from the project, the rural magistrate could requisition workers from other areas if local numbers were insufficient. This could on occasion function as a form of public assistance in so far as it provided temporary employment for poorer peasants.

For certain brief periods (for example, 1720-30), these procedures were replaced by an alternative method, by which the domain contracted with townsmen to undertake civil construction and repair projects (chōnin-ukeoi-sei). It is not clear why the domain would turn to contracting, but documents (cited in Satō 1967) indicate that it was dropped because of poor performance and alleged profiteering by the contractors.

Barring serious damage demanding immediate attention, the calendar of civil construction seems to have been as follows. In February and March, surveys and decisions about prospective projects were made by domain officials. Actual work, especially work on the intakes from the river, began in late March and continued until about the middle of May, when laborers returned home for transplanting. The period from late June through mid-August was often devoted to river embankment repairs, because the river was quite low in these summer months. With a break for the obon festival, projects could continue until mid-September, when the workers returned home for harvest. There was a final work season following harvest, from mid-October until mid-November when winter halted most projects (see Shōji and Satō 1962:93ff.).

Such were the procedures by which repairs and new construction along the domain rivers were to be handled. During the domain period, however, there appear to have been few major river improvement projects or significant river construction along the Aka River--or, for that matter, on other domain rivers. It is true that following the original river channel diversions by Niizeki in 1605-6, there were few recorded shifts in the natural course of the main river requiring major repair or digging. At the same time, there is little evidence of efforts to train the Aka River further to alleviate the persistent problems of flooding and drainage that plagued the basin throughout the domain period.

As one might expect, there are less than full details available to document this persistency and to quantify flood occurrences. Table 12 summarizes dates of known Aka River flooding, but these probably refer only to those which caused damage to the castle town and surrounding area.

The dates come from mid-nineteenth century sources, which probably explains the concentration of dates in the period, 1820-1860. In this forty-year period, there were thirteen recorded floods, seven of which were notated demizu and six of which, either kōzui or daikōzui. Demizu refers to flood levels which breach the river banks and damage areas commonly so inundated; kōzui refers to unusually high discharges that flood an even larger area. Along the Aka River, the sections of the natural levees most frequently breached were, on the right bank, those between the Inaba Main Canal intake and Matsuo and Akagawa Villages below. On the left bank, breaks often occurred between (and including) the Shōryūjigawa Main Canal intake and Ise-yokouchi Village. That is, the river reach from the top of the alluvial fan to around Tsuruoka remained vulnerable to heavy discharges.đ[2]

Table 12 shows that most reported flood discharges were in mid-summer, following a sudden rain, and written reports typically note that the Shōryūjigawa Main Canal intake and/or surrounding embankments were damaged and breached by the high water; this is of course the section where Niizeki built the original channel diversion embankments. This happened, for example, on August 11, 1833; rain began the night before, and by early morning the river had reached bankfill stage and then broke through the embankments. In a later report to the shogunate, the domain said that the river rose 3.9 meters above normal level, and that 84,841 koku of lands were damaged by subsequent flooding. Then, a month and a half later, there was a second heavy discharge which destroyed over 2000 meters of levees and embankments as well as damaging the Shōryūjigawa intake works and parts of the Nakagawa Main Canal (for contemporary accounts of the 1833 flooding, see OA 1974:704 and OB 1974:98-99).

Following this second flooding, the domain did finance a project to reinforce the levees between Ishino-shinden and Matsuo Villages on the right bank with a stone embankment. But significantly, other than and attempt to rechannel a short section of the river between Ise-yokouchi and Daihōji in the late 1850s, this is the only evidence of any attempt to improve source control and river training in the entire two and one-half centuries. It would appear that the common response to recurring flooding was simply to repair the damaged irrigation works, breached levees, and

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[42] Though circumstantial to the domain period, the more carefully recorded flooding in the immediate post-domain Meiji era is further evidence of persistent Aka River problems. Flood records exist for 1869.6, 1870.7, 1872.6, 1875.?, 1879.7, and 1881.?. In the 1879.7 flooding, almost 4000 hectares were inundated, while in 1881.?, about 2900 hectares were said to suffer flood damage. A river engineer estimated in 1897 that the 1879 and 1881 flood discharges exceeded 3750 cudm/sec. In the next fourteen years, from 1882 to 1896, another ten floods were recorded, with damage ranging from 150 to 1000 ha (Aka River Irrig Coop 1902:33-41).

Table 12

Reported flooding along the Aka River in the domain period

year	month/day	note	year	month/day	note
1663	Aug 12	#1	1827	late Aug/ early Sept	
1664	Aug 30	#2	1828	Aug	
1674	Aug		1833	Aug 11	#6
1682	May		1833*	late Sept/ early Oct	#6
1686	late Jun/ early Jul		1837*	?	
1726	Sept		1839*	Aug	
1729	Sept 2	#3	1840*	Aug	
1744	Aug		1845*	Sept	
1753	Aug		1850*	Aug	
1795	late Aug/ early Sept		1852	?	
1808	April	#4	1854*	late Sept/ early Oct	#7
1822	Aug 19	#5	1861	Jan	

* = demizu (see text)

Notes:

#1: damage to Shōryūjigawa intake
#2: damage to Shōryūjigawa intake, five bridges destroyed along Uchi River
#3: A 127.4 meter stretch of the Shōryūjigawa intake embankment was breached, and flood waters "surged" into the Uchi River, raising its height to 4.6 meters above normal.
#4: flood level discharge due to sudden spring thaw
#5: A 63.7 meter stretch of the embankments around Shōryūjigawa intake broke in high water caused by sudden, heavy rains.
#6: discussed in text
#7: Over 600 meters of river levees were breached.

Sources: OA 1974:702-7; S/S 1966:293-5; Aka River Irrig Coop 1902:33-41

channel banks through standard domain public works procedures.

For basin water users, of course, the Aka River served a dual role: in the headwaters and alluvial fan sections, it was their principal water source, while in its downstream section, it was the ultimate drainage outlet. In several respects, the downstream stretch of the Aka River presented even more complicated water flow difficulties than the alluvial fan mid-section. The flat grade through the low-lying deltaic plain meant a sluggish flow, which was further disrupted by the ninety-degree turn the channel was forced to make just below its confluence with the Ōyama River tributary, where it met the coastal dunes and was turned north. Then, in addition to the flood discharges from the spring melt and mid-summer storms, the downstream stretch also had to handle the drainage discharges from the entire Shōryūjigawa Main Canal service area, from a small southwest corner of the plain serviced by the upper Ōyama River tributary, and from a part of the Nakagawa Main Canal service area.[43]

Broadly speaking, there were two types of projects along this downstream stretch in the domain period: embankment building and channel straightening. The first was typically undertaken by individual villages at the time of first settlement; subsequent embankment repairs might receive domain financial assistance. The few instances of channel straightening were more extensive, involving labor from a number of villages and financial backing and technical direction from the domain, through its public works procedures.

Given the finer sand and silt sediment depositions in the downstream area and its very low elevation at or just above sea level, the river never built up very high natural levees; as chapter three described, the water table was high, and the soil waterlogged for much of the year. Thus, when this area began to be developed for paddy lands in the middle to late 1600s, an initial task of new settlements was to build up and reinforce the river banks--both for protection of village, fields, and irrigation channels and for improved drainage. It is instructive to return here to the example of Narita-shinden to understand the inter-village disputes that could ensue.

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[43] The Shōryūjigawa service area drained into the master stream proper and into the Yushiri-Ōyama tributary network, which then emptied into the master stream. Perhaps 35%-40% of the Nakagawa service area drained into the master stream while the balance, as well as all of the Inaba Main Canal service area, drained into the Kyōden-Fujishima River tributary network. The Kyōden-Fujishima network had less of an effect on the master stream than the Yushiri-Ōyama because it joined the master stream just above its outflow into the Mogami River at Sakata. The Kyōden-Fujishima River did share many of the same problems as the master stream, and it would contribute to the backing up of the master stream.

Obana Village, just upstream of Narita-shinden along the Ōyama River and predating it in time, had built a 692 meter embankment perpendicular to the Ōyama River (known as a yokodote) along the downstream boundary of its lands. When Narita Heizaemon founded his village in 1658, Obana Village, afraid that the development would increase the discharge into the Ōyama River and cause a backing up of the flow, made Narita promise to assume maintenance responsibility for the yokodote. Narita agreed but then proceeded to build embankments all around his villagees lands, both along the Aka River and the Ōyama River (see Map 4). The effect was to aggravate seriously Obana Villagees flood danger as water would now back up much farther and faster along the Ōyama River. Ironically, the better maintained the yokodote was, the worse the problem for Obana.

First records of the dispute between the two villages followed a flood in 1789, during which the yokodote was damaged. Narita villagers promptly repaired it, but later, villagers from Obana (and Tenshindō, which joined with Obana) broke it down. An agreement was reached through the conciliation of several village headmen and the Kyōden Village Group headman by which Obana and Tenshindō were to fix the embankment, but they delayed doing so. More flooding in 1795 caused further damage, and in 1796, Narita-shinden persuaded the district deputy to order its repair by Obana. Obana then shifted tactics and claimed that the customary height of the embankment was much lower than that at which Narita-shinden had maintained it (the recent flood damage had apparently much altered its height and shape) and that furthermore it was not a designated domain public works site (implying that the district deputyes order was not binding). The dispute eventually reached the attention of the domain rural affairs officer, one of the few irrigation-drainage cases that we are certain did reach that far. An inspection of old domain records yielded a 1715 document mentioning the yokodote embankment with measurements of 692 meters long, 7.3 meters wide, and 1.2-1.5 meters high and with a designation as a gofushin-tokoro (a "domain public works place"). Narita-shindenes contention was thus confirmed, but sporadic disputes about the embankmentes maintenance continued through the domain period.[44]

A year later, in 1802, Obana Village joined with Tenshindō and Higashi-nonuma Villages to build an embankment along the Ōyama River, but in so doing it became embroiled in another dispute. This embankment, connecting with existing ones upstream at Kakuda-futakuchi and downstream along Narita-shinden lands, provided a measure of protection for the right bank lands. Conversely, it caused the left bank villages to bear the brunt of high water discharges. The result was a prolonged disagreement

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[44] This discussion is based on 35 pages of documents relating to the dispute copied by the Narita-shinden Village headman in 1803 from petitions, directives, etc. at the district deputy office (published in Ose 1952).

between right bank and left bank villages (including a rivalry to see who could build and maintain the higher embankment) that was not resolved until a quarter of a century after the domain period as part of a comprehensive project of river training along the Ōyama River, which also settled the Ōyama-Narita dispute (YKS 1968:329-31).

An alternative river training strategy to improve drainage and high water discharge is channel straightening, which increases the flow velocity. A number of villages in the downstream area (including both Obana and Narita-shinden) joined to petition the domain repeatedly in the Kyōhō era (1716-1736) for a project to rechannel the master stream into a straighter course from Inoko to Sakanobe (about 3.64 km). These were all turned down, but in 1732, the domain did agree to a small project whiche would improve the channel from Kuromori to Sakanobe (about 1.85 km), that is, from the Ōyama confluence to the outlet at the Mogami River. From project documents, it appears that 150 workers were used for five days in July of that year; they were recruited from 11 villages in the downstream area at the rate of 3.35 workers per 100 koku of assessed village yield.

The 1732 project was said to have improved drainage, but in 1747, after particularly severe flooding at the Ōyama-master stream confluence, the villages petitioned anew for improvements to the river channel between Narita and Kuromori; the domain, however, rejected the proposal, citing the fact that it had on-going projects elsewhere in the domain.

Finally, in 1840, a joint petition of nine villages on the left bank of the Ōyama and on both sides of the master stream below the confluence proposed that the domain organize a project to dig an excess water channel through the coastal dunes at Kuromori to allow direct access to the sea. The domain refused, citing the heavy expenses such a project would require. This coastal dune cut-off was not done until the 1920s; it did substantially ameliorate the flooding and drainage problems that continued up to that time (YKS 1968:328-331; Aka River Irrig Coop 1905:11-13; S/S 1966:9-10)e

In sum, there would appear to have been very little change in either the degree or techniques of river training for high water discharges. There were some embankments constructed around new villages in the downstream area and an occasional attempt at channel straightening in both the upstream and downstream areas, but most work consisted of repairs of natural levee breaks and damage to irrigation intakes and canals caused by high water discharges. This is surprising because damage was continual in the downstream area and frequent in the alluvial fan sections--not only in terms of facility damage but also in terms of crop losses from inundation, long-term effects on soil from water-logging, and difficulties in cultivation practices (e.g., harvesting is much more difficult when fields do not drain properly and remain wet). Domain public works procedures worked well enough to handle repairs, but the petitions for new projects that were consistently rejected by the domain reveal its unwillingness to

invest in more permanent and preventive solutions to high water and drainage problems. At the same time, there were few instances of supra-village level organizational initiatives alternative to domain administration.

In addition to river training, another facet of source control in the basin was the headwaters forest, which is said to have been actively managed by the domain for the purpose of watershed conservation, although there are no surviving records that clearly express this intent (Aka River Irrig Coop 1904; S/S 1966:140). Forestlands, like major rivers, were within the jurisdiction of the rural magistrates. Each had in his office four assistants for forestry affairs, two for each of the two districts the magistrate was assigned. In the forestlands themselves, guards (yama mori) were appointed from nearby villages (Shōji and Satō 1962:93ff.).

Forestlands actually presented an ill-defined pattern of multiple ownership and usufruct, due in part to the multiple and renewable resource nature of forest lands at the timee Grass was cut for fodder, compost, and green fertilizer; brush and small trees were used for firewood, while brush and larger trees were used for charcoal-making; the larger trees were also felled for construction timbers; stones were gathered for various building purposes; wild plants were gathered for food and medicine; and even earth was excavated for fill in embankment projects.

As with arable lands and surface water, the domain lord's claim, however preeminent, was not exclusive. In contrast to arable land, though, there was in Shōnai no survey and registry of forestlands, nor were rights assigned to the extent that individual households or villages incurred tax obligations. Rather, forestland usufruct (known as iriai-ken), like that of rivers, was based on certain customary uses of its resourcese Forestland was divided and claimed territorially by settlement village units, which treated 'their' forest as commons and were allowed to regulate entry and use. Such customary claims to regulation and use predated the Tokugawa period in many parts of the country and some areas of Shōnai Domain.[45]

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[45] With 85% of Japanese land at a slope greater than 15 degrees and little of that settled or cultivated, forestland is generally synonomous with mountain land and is extensive and valuabłee The history of iriai-ken is long and complex (see Kawashima et al. 1959), but specification of and contention over rights typically reflected the value of the forestland resources. Where commercial exploitation was feasible, vertical disputes between villages, merchants, and domain lord were frequent; where population density was high, horizontal disputes between villages were common.

Yet it was probably not difficult for the domain to manage forestland in the Aka River headwaters for watershed conservation--that is, to regulate timber cutting. This part of the basin was sparsely settled (about twenty villages in the 550 sq km of the upper basin) and rather inaccessible to villages on the plain. There was little commerciald logging; the domain satisfied its needs by requiring headwaters villages to deliver cut logs in payment of their tax levies.d[46]

Maintaining a forest cover in the headwaters retards surface run-off and thus not only reduces the force of a sudden spring thaw or a mid-summer storm but also in so doing may increase the river volume in the following low-water periods. However, the average August discharge of only 15-20 cudm/sec suggests that even a well-maintained forest cover in an extensive headwaters was of limited value. A more effective solution to the low water troughs would have been ponding behind dams along the river or tributary streams, but I do not believe an appreciable reservoir storage along the Aka River was within the technology of the period. In fact, large storage volumes were not possible until the dam construction of the 1950s. Ponding has had at least a 1600-year history in Japan, but headwaters damming of the large and fast rivers of northeast Japan has been beyond all but the most recent engineering.

On the other hand, from a technical standpoint, it would not have been surprising to have seen further training of the Aka River channel in light of major advances in river and flood control engineering in the sixteenth

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[46] These logs were floated down the river to Tsuruoka, and together with small boat navigation between Tsuruoka and Sakata and water for municipal and castle moat supply, constituted those alternative uses of Aka River water potentially competitive with irrigation. The logs were known as "8-shaku trees" (hasshaku-ki) because an itaya kaede tree (a kind of maple) 8 shaku long (2.42 m) with a trunk diameter of 1 shaku (0.303 m) was set as a standard equivalent of 1 bag of rice tax. Because of possible damage to the Shōryūjigawa Main Canal intake, a special intake was built below the Shōryūjigawa intake for the logs, which were then floated into the main canal channel to the Uchi River and by the Uchi River into Tsuruoka. There was a complaint in 1726 by eleven downstream villages asking the domain rural affairs officer to prevent any use of the river by the loggers until after the irrigation season; they claimed that to move the logs through the Uchi River to Tsuruoka required that an extra volume of water be diverted from the main channel into the Uchi River, reducing the volume to downstream branch canals at a time when they were suffering shortages. There is, however, no further evidence of any problems between loggers and irrigators, and I judge the logging to have been of minor consequence and competition to the irrigators. Indeed, the available evidence shows few conflicts between irrigators and other river water users (boatmen, loggers, municipal users), in sharp contrast to the problems

to eighteenth centuries, especially in central Japan; these included various techniques of embanking, diking, double-banking, controlled flooding, and so forth developed by engineers of several domains and the shogunate. These would not necessarily have improved source control along the Aka River because of the upstream location of the intakes, but it certainly would have mitigated some of the serious drainage problems in the downstream areas as well as the general flood danger along the length of the river.

The reasons for domain reluctance to sponsor major river training projects such as dredging and rechanneling were probably more financial than technical, as its rejection of the request for a direct Aka River cut-off through the coastal dunes reflects. The labor requirements of such projects exceeded normal corvee requisitions and would have drained increasingly tight domain income. Moreover, the domain would have left itself open to further claims on its public works funds. Given a respect for precedents, a site which once obtained public works assistance could thereafter have expected to receive continued support for repairs. And, as irrigation cooperative members discovered in the Meiji era when they obtained river training improvements in the alluvial fan section, a project which improved river flow in the midstream section exacerbated flow in unimproved downstream sections; the domain, in improving one section of the river, might have found it necessary to improve other, adversely affected sections. And finally, investment in such river projects along the Aka River might have increased pressure to assist major training of other troublesome rivers such as the Nikkō and Arase Rivers north of the Mogami.

Instead, the basin irrigators dealt with the mid-summer stretches of low river levels by setting out temporary weirs at least part way across the river at the intakes to the larger main canals; it is not clear if the weirs were used at the very small intakes. The weirs were used to raise the river level at the point of intake and to direct river water towards the intake cut. They consisted of a line of triangular stake frames, a common construction known as ushi-kura and used for river control and diversion weirs in Japan at least as far back as the eighth century, AD (Aki 1975:484-6). Cut poles were joined with straw rope to form a triangular frame and then weighted down with sand-filled bags. These frames would be set in a line perpendicular to the flow. Stakes might be driven into the river bed along the upstream side of the log frames and then faced with straw mats, rocks, and packed mud. These weirs were usually set out in late June, after the spring snow melt and at the start of the summer low water period.

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along other rivers, such as the Takahashi in Okayama (S/S 1974:329-35).

The weirs were maintained as part of the intake works of the delivery canal networks, and details of the Shōryūjigawa and Nakagawa weirs and intakes will be taken up in the following chapters.e For the moment, in terms of source control, the issue raised by the use of the weirs in low river water periods is that of allocation of the source water among the several delivery networks. Determining this allocation, though, raises again the intractable problem of studying historical irrigation, the confounding paucity and incompleteness of documentary evidence. Amazingly, there survives only a single reference to the allocation of Akae River water during the entire domain period.

This reference appears in the course of a 1794 petition from and official response to villages of three tailend branch canals of the Shōryūjigawa Main Canal, which sought some relief to water shortages (S/S 1974e88). One of their three requests was that the line of triangular frames that composed the Shōryūjigawa weir be extended all the way across the Aka River. The petition was forwarded to the district deputy by the village group headman and was the subject of discussion among other (unspecified) village group headmen summoned by the district deputy. They decided that the request was inappropriate and might cause future trouble as there was no precedent for such a step. The official reply noted that the "traditional allocation" formula of Aka River water was seven parts to Shōryūjigawa and three parts to Nakagawa. The seven parts to the Shōryūjigawa intake were further divided: two parts were allocated to the Uchi River (the improved natural stream channel off the Shōryūjigawa Main Canal, which functioned as a branch canal and served both irrigation and castle town needs) and five parts served the remaining main canal service area.

The domain rejection does not elaborate how this seven-three principle was actually applied and enforced, nor does it detail its origins in 'traditional and customary practice.è Moreover, it does not mention just how the "Nakagawa three parts" were in fact distributed among the remaining intakes downstream of Shōryūjigawa.[47] It does imply: (a) that the Shōryūjigawa Main Canal service area did not enjoy unlimited access to Aka River water; (b) that river water allocation was proportional to discharge volume (as opposed to division by prior appropriation); and (c) that domain administrative authority could and did on occasion protect this traditional allocation formula.

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[47] There were six intakes downstream from Shōryūjigawa: Nakagawa, the second largest service area, Inaba, the third largest, and four much smaller canal networks. I interpret "Nakagawa three parts" to mean the water volume to be passed through, over, and around the Shōryūjigawa weir for use by all of these downstream networks.

In view of considerable surviving evidence of allocation specifics and conflict over river water in other Japanese basins during the Tokugawa period (to cite the Takahashi River as but a single example: Fujii & Kahara 1977), the absence of such records in Shōnai is unusual. It is all the more surprising in light of the records of frequent conflict within the various main canal networks, to be discussed in later chapters. Was there conflict over source control and river water allocation, and documentation has simply disappeared or remained uncovered? Or, was there actually little conflict at this level?

There are a number of reasons which support the judgement that there was little serious conflict at the river level in the domain period. First, the three largest main canals were put into operation at roughly the same time (1615), and thus historical precedence (prior appropriation), a principal legitimating basis of customary claims, was difficult to establish. This was soon followed by the creation of a domain administrative framework that was of potential application to irrigation affairs but which cross-cut the irrigation networks.

A third reason is that it was not in the interests of the domain to allow unilateral appropriation by the upstream Shōryūjigawa Main Canal. Chapter two has demonstrated that the taxation system, which was the domain's method of extracting agricultural production, was served better by maintaining a certain level of production throughout registered lands than by maximizing production in a single area. To a certain point, shortages in water were better distributed widely through the basin than allowed to fall in downstream areas only.

A fourth and related factor stems from another feature of the taxation system; domain revenues were increased more by expansion of registered arable lands than by increases in land productivity of existing paddy land. This was of course why the domain promoted development of the downstream areas of the basin. Each of the larger main canals served both older paddy lands on the alluvial fan and new paddy lands on the downstream plain. Again, it was not in the interests of the domain to support attempts to alter water source allocation and increase Shōryūjigawa's share at the expense of the other main canals.

This is not to argue that domain officials actively intervened to insure fair and conflict-free allocation of river water; it is rather to suggest that domain authority was lent to the preservation of the status quo. Allocation of river water was determined by the dimensions and design of the weirs and the intakes. To prohibit and prevent changes in these dimensions and designs would have been sufficient to maintain allocation at the same relative level. There was still probably some violence, perhaps the occasional, noctural dismantling or damaging of lengths of weirs that one hears of for the twentieth century. But domain support for the status quo would have served to discourage litigation and other conflict modes on the river level.

Given a reflexive domain stance in the face of sizeable yet variable expansion of paddy lands in the basin, one might expect to find some alternative organizing initiative among basin irrigators to tackle the river problems the domain was not actively addressing. However, the available evidence suggests that, paradoxically, on the river level neither sustained conflict nor alternative organization was forthcoming. I should hasten to add that the next two chapters will detail many instances of both conflict and cooperation at the village and branch canal levels. The point here is that there do not appear to have been any broader coalescences of interests--for example, of lower basin irrigators versus alluvial fan section irrigators over high water drainage discharges or of downstream main canals versus Shōryūjigawa Main Canal over low water allocation. With both high water discharges and low water allocation, the common locus of conflict was among the injured parties, as illustrated by the persistent conflict between Narita and Obana Villages.

There were perhaps two reasons why water user discontent remained unorganized at the river level. First, it was difficult to coordinate interests within the main canal service areas because the effects of source water allocation were differentially distributed. Unlike canal patterns in other basins, both Shōryūjigawa, with an 'upstream' intake, and Inaba and Nakagawa, with 'downstream' intakes, stretched from the alluvial fan out on to the downstream plain. Shortages from an inequitable allocation of source water seem to have been localized in the downstream areas of Inaba and Nakagawa, making concerted action by the entire main canal service areas less likely. Moreover, these downstream areas affected most by such allocations had high concentration of new, leniently registered and taxed paddy lands; we may presume that land holders in these areas were reluctant to press water claims too explicitly in fear of adverse consequences for land tenuree

In sum, a technology and organizational pattern for river control to provide a water supply and drainage outlet minimally adequate for rice cultivation was established in the basin in the early to mid-seventeenth century. At this time the official domain hierarchy claimed a comprehensive authority over agricultural production and land tenure, and decision making tasks concerning source control and drainage were embedded in the domain administration. Necessary labor and materials were generated through the domain tax systeme Still, such management wase passive and reluctant. It responded, favorably or unfavorably, to claims and petitions from below, but it never seized the initiative to clarify the ambiguous nature of rights to river water, to specify allocation practices, or to organize drainage schedules that might have increased water use efficiency and prevented readily anticipated damage. With high water damage and low water allocation, it acted to restore and preserve the existing facilities and/or procedures, mindful of the status quo and wary of any changes to it. Levees were repaired, the headwaters forest was preserved, and the log frame weirs were set out each summer, but there is little evidence of major steps taken to develop storage capabilities.

Although the effects of both high water flooding and low water shortages were exacerbated by the expansion of paddy fields through the basin, this minimal technical order and conservative, domain-embedded organizational framework for river control persisted. I have suggested that this was becauseeof and not despite a growing dissonance in ethe configuration of administration, land tenure, and irrigation interests; this is a point to be developed with more evidence in the next two chapters, which take up delivery, use, and drainage within the two largest canal networks.

Chapter V

THE SHŌRYŪJIGAWA NETWORK

We turn our attention now to the organizational and operational details of two of the basin canal networks. This chapter treats the Shōryūjigawa network, which had the largest service area in the basin and the most upstream intake of the three major networks. In the following chapter, I will consider the Nakagawa network, serving the second largest area in the basin from an intake that was the most downstream of the major networks. In each case, I will draw from surviving documents a portrait of who was handling in what manner the various tasks of construction and reconstruction, operation and maintenance, water allocation, and dispute resolution. I believe these chapters to demonstrate that, overall, both networks were characterized by a dispersed control over these tasks through most of the period. Several tasks were nominally articulated to domain administration, but domain officials showed a reluctance to exercise authority. There was little evident involvement in network matters by the merchants who began to accumulate large holdings in the mid-eighteenth century. And, there were few appearances of formal, effective supra-village associations of water users at either the branch canal or main canal levels throughout the period. I shall reserve for the final chapter an interpretation of how developments in domain political economy insured the persistence of this form of irrigation organization.

We saw in chapter one that the 1605-6 river diversion and embankment project at Kumaide immediately sparked canal construction, which in turn led to a century of paddy land development and expansion through the basin. Digging of the Shōryūjigawa Main Canal (in essence, the construction of the gate at Kumaide and a modification of the former Aka River channel) reflected the common pattern of irrigation construction in the basin--that is, local initiative and resources sanctioned, or at least encouraged, by domain officials.

The principal coordinator of the Shōryūjigawa project is thought to have been Kudō Kamon, on the basis of a Kudō family document presented to the domain lord by the Kudō household in 1851 (text in S/S 1974:6-7, 9-10). According to this record, Kamon was the son of Kudō Kageyuzaemon, the headman of Hongō Village (now Honden) on the plain north of Tsuruoka. The Kudō family had lived for many years in Ōtori Village, in the upper basin of the Aka River; in the 1570s, Kageyuzaemon moved down on to the plain and became headman of the new village of Hongō.

Following the transfer of Shōnai to the Mogami domain in 1601, there were some attempts by the new district deputy (daikan) under Niizeki, Fujiwara Mino, and by Kamon's father, Kageyuzaemon, to tap water of the Mizunashi River and the other intermittent streams that ran off Mount Hōkari into the old Aka River channel. However, they proved unstable and insufficient sources, and the efforts apparently failed. Kamon himself may have been associated with Niizeki's river diversion project (Koide 1975:97) before undertaking direction of the Shōryūjigawa canal. The canal seems to have been more or less completed by 1610-11.

Unfortunately the Kudō record provides no details of the canal investment required in this project. Kamon secured permission, and perhaps encouragement, from Niizeki. The Kudō record claims that construction of the intake works (sekiguchi toritate) resulted in Kudō's receiving from the domain the administrative right over the canale (yōsuigawa shihai, literally, "management of the irrigation river"), though Kamon later for unknown reasons transferred this right to Jirozaemon of Takadamugi Village, with whom he had worked on the project. But there is no indication of labor requisitions or financial assistance received from the domain. Rather, he must have organized leaders of settlements along the line of the main canal and directed cultivator-laborers mobilized by the settlement leaders. The incentive to participate was the possibility of constructing a turn-out from the main canal and using the water to expand paddy land acreage in one's own area. Participation could be solicited through the promise of rights to the canal water.

Obviously, Kamon's ability and incentive to coordinate such a project derived from the position of the Kudō household as a wealthy, local peasant leader (dogō)e We get a glimpse of this from a fragment of the 1611 land records for Hongō Village. At the time, just following the completion of the canal, the village had paddy lands with an assessed yield of 26,268 kari-soku and dry fields of 21.497 koku, for a total of 218.301 koku in assessed lands. Of this, about 19,700 kari-soku of paddy lands and 18.9 koku of dry fields were fief lands of Wada Etchū, a Mogami retainer resident at Tsuruoka castle, while about 1900 kari-soku of paddy lands were direct fief lands of Mogami.

There were 37 cultivators named (as naukenin) on the Hongō cadastral register. Listed by paddy field holdings:

paddy land over 1500 kari-soku:	3	cultivators
paddy land of 1200-1500 kari-soku:	2	"
" 900-1200 "	10	"
" 600-900 "	4	"
" 300-600 "	9	"
" less than 300 "	9	"

Two of the three cultivators with holdings above 1500 kari-soku were Kageyuzaemon and his son, Kamon. Furthermore, most of Kageyuzaemon's holdings were free of tax obligations; as headman, in return for tax-collecting and other administrative functions, he received taxd exemptions for much of his own land (kimoiri-bun). His paddy holdings totalled 5695 kari-soku (or roughly 22% of the entire village holdings) and consisted of the following:

fief lands of Wada Etchū:	745	kari-soku
direct holdings of Mogami:	175	"
non-taxed headman lands:	4775	"

The Hongō cadastral record fragment suggests, at least for this particular settlement, considerable stratification in holdings and, in the Kudōs, resources and incentives for initiative and investment in irrigation improvement.

At the Shōryūjigawa intake works at Kumaide, river water was diverted by the log frame weir to a large, gated intake, the most substantial works in the basin (see Map 6). The main canal itself, about twenty kilometers in length, ranged in width from six to twelve meters; although wider in the upper section, it did not narrow uniformly. It ran through the west bank paddy lands in a northward direction from the intake, passing to the west of the castle town and eventually emptying back into the Aka River. Its major branch, the Uchi River, diverged near the village of Kawahara about two kilometers below the Kumaide intake; the Uchi River was about ten kilometers long, and after winding through the castle town (where it served municipal needs and replenished the moat works), it too emptied back into the Aka River. By 1658 along the main canal, there were intakes to twenty-seven branch canals, with an additional ten intakes along the Uchi River.

After the Kumaide intake works, these 37 branch canal intakes, or "water diversion points" (bunsuijō) as they were termed, were the primary structures along the main canal. The wide variation in design and dimensions was the source of much contention as we shall see. The branch canals themselves were simply narrower and shorter versions of the main canal--unlined earth channels with a minimum of improvements at difficult points. Water moved by gravity-flow, and because the land grade evened out towards the downstream plain section, it was necessary to go quite far up to take off from the main canal. As a consequence, a branch canal might pass through lands of several villages before reaching its service area, which could extend over one to fourteen villages.

The branch canals each fed a number of usually named tertiary laterals, which in turn delivered water to the field ditches that actually supplied the paddy fields. Only rarely were there permanent gates at the diversions along a branch canal to its tertiary laterals; more commonly, water movement at this level was regulated by the temporary placement of

sand bags, boards, mats, and mud. Field ditches also collected drainage water from the paddy parcels and emptied back into the laterals and branch canal at a downstream point or else into laterals of a second branch canal below the delivery source. Branch canals withdintakes on the right side of the main canaldtended to empty back into the Aka River or into downstream branch canals. Those on the left side of the main canal generally flowed into the Ōyama River tributary.

From at least the 1650s, this service area extended over eighty-seven administrative villages on the alluvial fan and downstream plain, roughly between the master stream and its Ōyama River tributary to the west. These eighty-seven villages fell within eight different administrative jurisdictions: most Shōryūjigawa villages were assigned to five village groups (kumi) of Shōnai Domain, only one of which was wholly within the service area boundary. However, some service area villages had come under direct shogunate administration, while others fell within the territory of the Maruoka Branch Domain of the Sakai family. There was also a small amount of land in three villages which was controlled by the Mt. Haguro temple complex.d

In 1659, the total registered paddy land yield of the service area was 26,046.5884 koku, which I estimate to be about 2188 registered hectares.d[48] By 1833, this registered yield increased to 31,828.6568 koku (about 2917 registered hectares by my estimate) due to paddy land expansion within service area villages. However, the official acreage in 1878, following the Land Tax survey, was 3910 hectares, confirming that there had been much unregistered or underregistered expansion within the Shōryūjigawa network during the period.

The Kumaide intake works

As we have seen in chapter one, after initial construction of the intake and main canal, rights to main canal management were first accorded Kudō Kamon by the lord Mogami. Kudō, however, for reasons unknown, soon passed them to Jirozaemon of nearby Takadamugi Village, who was apparently appointed Chief Canal Guard (ōsekimori) of the main canal after Sakai became domain lord. A second ōsekimori was appointed from another service

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[48] I have estimated acreage equivalencies in 1658 and 1833 in the following way. The cadastral formula for yield per area unit ranged from 0.9 to 1.5 koku per 1 tan, depending on the quality grade of the field. For 1658, I assumed a mean quality grade of 1.2 koku per tan, and for 1833, after much new paddy land development commonly graded at 0.9 koku per tan, I assumed a mean of 1.1 koku per tan. These figures, it bears reiterating, represent registered yield totals, not actual yields.

area village.

There was a further elaboration in irrigation organization in 1660. In November of that year the headmen of the six west bank villages nearest to Kumaide intake (see Map 7) sent a petition to the rural magistrate complaining that the demands of maintaining the intake facilities posed a heavy burden. They claimed that from April 7th through November 8th of 1660 they had expended a total of 15,350 worker-days and considerable material supplies in intake repairs and maintenance (the petition is reprinted in S/S 1974:59-61 and YKS 1961b:192-3).

In reply, the domain official conferred formal responsibility for intake works maintenance of these six villages; they were exempted from payment of the miscellaneous taxes (komononari) and from all corvee; instead, these commodities and labor were to be used for intake maintenance. At the same time, the headman of Kumaide Village, Hachiemon, was apparently appointed Chief Intake Guard (ōsekimori) and charged with organizing the intake works maintenance. (This appointment is not explicitly mentioned in the document; it is first confirmed in a 1688 document, and by 1702, there were two persons in Kumaide Village with this title.)

It is only possible to construct a partial listing of the Kyōden and Kumaide ōsekimori during the Tokugawa period (see Kelly 1980:279). We have the most complete information about the line of the first Kumaide ōsekimori, Hachiemon, as it is the record maintained by his household that provides much of our data on the intake during the period. Beginning with Hachiemon (possibly in 1660, at least by 1688), this household served for three generations as both Kumaide village headman and as the intake works ōsekimori. Then, in 1774, for reasons unknown, the third generation household head, Kihachi, was banished from Kumaide by domain order, and both posts were given to Sajiemon, head of a branch household (bunke). The posts continued in this household for another three generations (S/S 1974:66-70).

In 1732, the annual salary allowance to the Kyōden ōsekimori was six bags of rice (432 liters) each and to the Kumaide ōsekimori, about 1 bag each (72 liters). This was collected from all villages in the main canal service area in proportion to each village's registered yield within the main canal service area. The Kumaide ōsekimori received an additional six bags each from the district officer, so that their total salaries slightly exceeded those of the Kyōden ōsekimori.

Thus, by the early 1700s, there were separate roles for main canal maintenance and for intake works maintenance, both termed ōsekimori and both occupied by two individuals. At this point, the intake works ōsekimori were subordinatedto the main canal ōsekimori, but in the following decades, a shift in authority occurred: while the post of Kyōden ōsekimori continued, the duties became obscure and it no longer

figured in allocation and maintenance matters discussed in surviving documents. At the same time, the Kumaide ōsekimori came under the direct jurisdiction of the district-level domain officials.

The Kumaide intake works themselves consisted of the diversion weir, a gate intake, and a spillway just in front of the gated intake. The weir was described in chapter three as a line of triangular stake frames set out across the river after the spring flood discharge to raise the summer river water level and direct water to the intake. There is no surviving map of the intake area in the domain period, but document descriptions and an 1886 map suggest that there was an island in the middle of the river channel in front of the Shōryūjigawa intake and that the intake weir extended from the island to the right bank of the river (see Map 7).

The earliest recorded dimensions of the intake gate date from 1818. At that time, the opening was reinforced by buttresses (sode) on either side; on the upstream side, the standing log buttress was 14.56 meters long, and on the downstream side, 10.92 meters (the latter was lengthened to 12.74 m in 1840). The opening itself (agekuchi) was 7.9 meters wide, with a gate height of 3.7 meters (raised to 4.0 meters in 1840). The maximum gate height opening, however, was fixed at 1.06 meters from the base log (sekidai) to the bottom of the gate itself, which was constructed with massive horizontal logs known as metagi (S/S 1974:190-91; see figure 4).

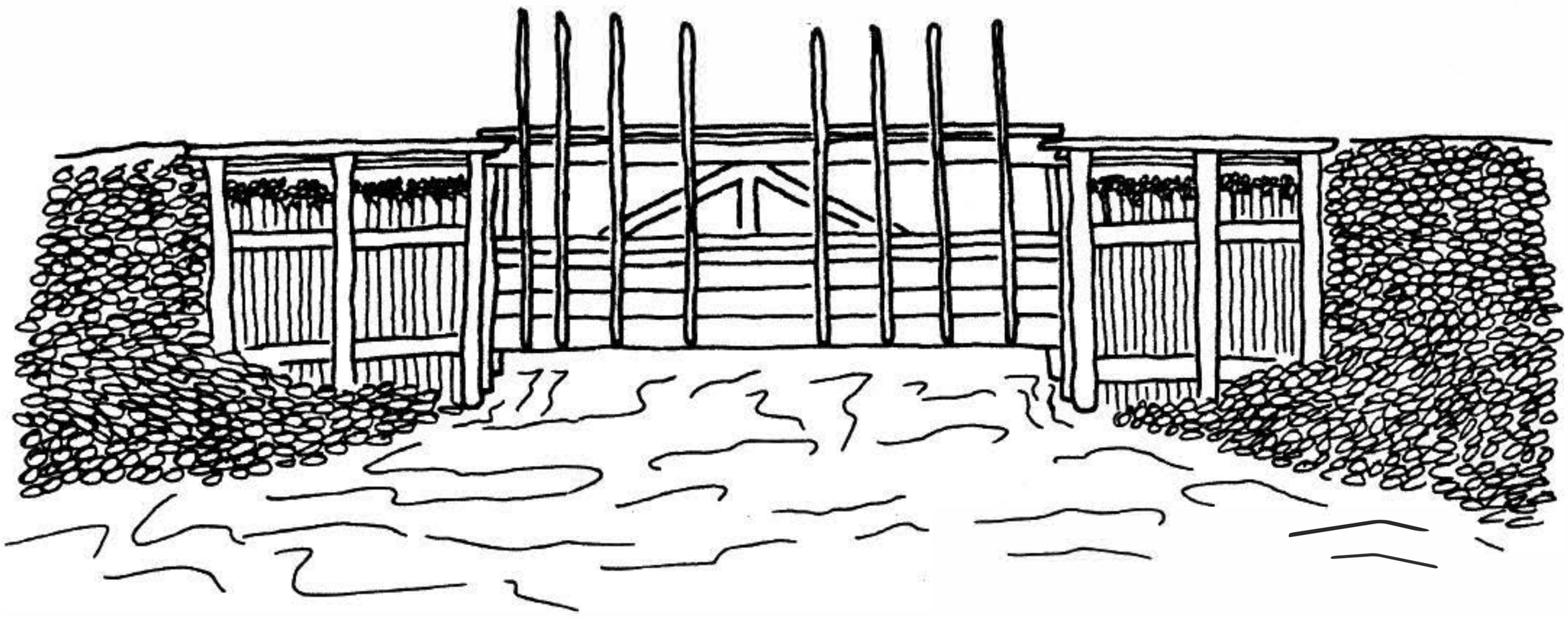
The spillway is rarely mentioned in documents about the intake, although as an unlined channel leading back to the river, it served the important function of preventing excess water from entering the intake in times of sudden high river discharge; if it was not opened, the intake gate and main channel could (and did) sustain serious damage.

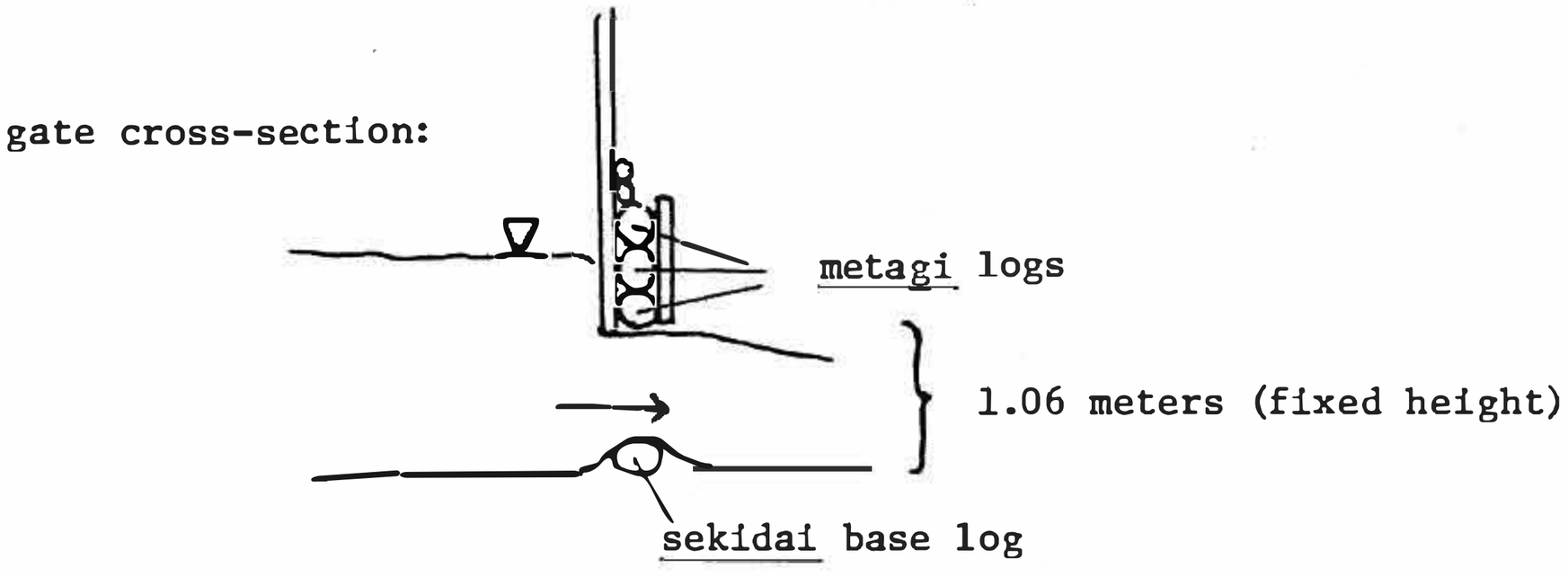
Maintenance of the Shōryūjigawa intake works required three tasks. The diversion weir had to be set out in times of low water, dismantled in the fall and repaired when broken by flood discharges. The river bottom in front of the intake gate and the canal bed behind the gate had to be dredged of accumulating debris and sediment. And, the intake gate itself had to be operated, repaired, and, on occasion, completely rebuilt.

We have seen that the maintenance and management of the diversion weir was the responsibility of the six villages under the two Kumaide ōsekimori; these villagers supplied both labor and materials. They were also responsible for ordinary maintenance and operation of the intake gate and for annual dredging around the gate. Their charge, essentially, was to insure and maintain an adequate and customary flow into the main canal and to protect the intake works and canal from high water damage.

It was not without difficulty that these duties were discharged, and in fact mounting problems in the nineteenth century forced a shift in intake maintenance practices in 1840. In large part, these problems resulted from the increasing demand for water in the main canal service area as a

Figure 4: A hypothetical drawing of the Shōryūjigawa Main Canal intake at Kumaide





Source: Based on list of construction materials, 1840-64 in S/S 1974:190 and on Meiji period photographs (Shoryujigawa Irrig Coop 1935).

result of downstream paddy land development. Furthermore, there were repeated major breaks and damage to the intake works due to high river discharges, requiring frequent repairs. Both factors placed heavy burdens on the six Kumaide area villages and on the ōsekimori. For example, on the occasion of the major 1833 flood discussed in chapter three, rural magistrate officials visited the house of the ōsekimori Kyūshichi to emphasize the difficulty to the domain in providing necessary repair materials. Kumaide village burden was compounded by a poor harvest that year. Again in 1839, there was serious flood damage to the intake works, and the total labor demand that year was 13,704 workers; this compared to previous levels of 2,000 to 3,000.

It appears that the burden felt most heavily by the residents of the six villages was increasing tax levies. We have seen that in the seventeenth century the villages were exempted by the domain lord from certain taxes and corvee duties. Instead, they supplied without reimbursement all materials and labor necessary for intake maintenance. This changed, however, in about 1730; from that time, a public works levy (at the domain standard of 2.8% of village registered yield) and a non-rice product duty (though payable in rice) were collected by the domain--and turned back to the six villages for intake works maintenance. It was an accounting sleight-of-hand, but it represented a shift from corvee to wage labor, from requisitioning materials to buying them. The tax monies, that is, were used by the ōsekimori to hire village residents and buy necessary mats, rope, stakes, etc. from them.

Discontent was evident by the nineteenth century when more workers were needed than tax money could hire. It is not clear whether this was handled by reducing wages, simply conscripting extra workers, or adding a tax surcharge to the public works levy. In any case, in late May or early June of 1841, an assembly of registered farmers of the six villages met and decided on a new system of intake works maintenance whereby responsibility for maintenance and repairs (except for the reconstruction every twelve years) would be given to 'contractors'd Domain officials, judging from a communication of the previous year to the ōsekimori, were not in favor of such a change. The ōsekimori, who retained operating responsibility for the intake, supported it (see S/S 1974:148-179 and YKS 1980:675-679 on which this discussion of the contractor system is based).

The aim of the new system was to limit the tax liability of six-village taxpayers. In the 1840s, the combined registered yield of the six villages was 1589.0377 koku. Thus, their public works levy, at the standard rate of 2.8%, was 44.492 koku; in addition, they paid 8.5898 koku as a materials and produce tax. From this total (53.0818 koku) was subtracted (a) 3.3450 koku for two ōsekimori salaries (b) 1.6725 koku for one kosekimori salary[49] (c) 0.334 koku given to the shrine in Kumaide

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[49] This is the only reference to a kosekimori, or "lesser intake guard."

village; and (d) 0.840 koku, divided among the 18 officials of the six villages for expenses (koban-mai). This left the sum of 46.8903 koku, which at the prevailing wage rate of 1 sho 4 go (0.014 koku) per day, represented wages for 3,349.1 worker dayse

The new system divided this sum equally among thirteen individual contractors, who assumed joint responsibility for intake maintenance. There are no records of how the thirteen actually divided repair work; it would seem to have been a complicated matter. Nevertheless, the principle was that if a contractor met his responsibilities within the annual budget alloted him, he turned a profit; any amount he was forced to spend above that was his personal loss.

This contractor system appeared to work smoothly in the 1840s. In 1848, the ōsekimori, perhaps to retain some control over contractor activities, appointed two of them to be head contractors and authorized each of them to take an annual allowance of 1 koku from the total budget. At the same time, they required of these two that they pay them 5 ryō in gold coin as "insurance money" (hoshō-kin) in the event that a contractor would be derelict. This seems to have become an annual levy and was never returned. It is difficult to judge the intentions of the ōsekimori on this as well as other points; perhaps their concern was legitimate, perhaps the money amounted to a kickback. It was the case that in 1853, noting that river conditions had improved (and implicitly, that contractor profits were increasing), the ōsekimori asked each contractor for 1.6 koku (per year?; see S/S 1974:453-54).

This contractor system continued for 23 years until 1863, the year before a scheduled reconstruction of the intake workse In 1863, there were a number of requests from individuals to become contractorse and in February of 1864, the two ōsekimori and the headmen of the six villages met to decide whether to continue the contractor system at its present thirteen, to expand the number of contractors, or to appoint the two ōsekimori as sole contractors. A month later, the ōsekimori had secured the approval of the various village assemblies (at their spring meetings) for the third alternative. It is significant that this was not a return to the old procedure; this time, the ōsekimori were to operate as the contractors had--given a fixed annual sum by the six villages, they had to handle intake maintenance within that budget or cover additional expenses from their own pocketse

At least in the closing decades of the Tokugawa period, then, taxpaying cultivators of the six villages were able successfully to limit their liability in maintaining the Shōryūjigawa intake works. It is difficult to determine whether the increasing burdens of the 1820s and 1830s that prompted the new system reflected real increases in maintenance demands or

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Subordinate to the ōsekimori, his duties are not clear.

whether they arose from manipulations of money and labor by the ōsekimori for personal profit. From Table 13 one can see that most registered paddy-land owners in the six village areas were small-scale cultivators; 77.4% held less than 10 koku of land. There were none of the large landlords of fifty or hundred koku who were appearing in the downstream areas; Kumaide was an area of old paddy land, hemmed in by the mountains, with only limited flat land. The four largest land holders were:

Sazaemon	(Kumaide)	31.727 koku
Jirozaemon	(Kumaide)	35.596 koku
Yosozaemon	(Kōya)	32.080 koku
Mataemon	(Katakai)	40.066 koku

Sazaemon was the household of the ōsekimori Kyūshichi; unfortunately, we do not know the holdings of the other ōsekimori, Gihachirō (holdings are listed by household name). It is clear, though, that Kyūshichi had much larger holdings than both the village headmen and the thirteen contractors. The headmen tended to come from the middle stratum of 15-20 koku land holders, while the contractors represented a wider range of holdings (mean of 10.5 koku, with a high of 23.051 koku and a low of 0.0 koku, the Kumaide shrine priest). These are grounds for suspecting some conflict of interest between the upper stratum ōsekimori and the middle and lower strata land holders, but the differential power is difficult to assess. Certainly the ōsekimori's actions in the 1850s in appointing head contractors and then collecting "insurance money" from them and 'refunds' of 1.6 koku from each of the thirteen contractors and their success in 1863 in regaining control of intake maintenance reflects a degree of influence over the villagers. Still, the ability of the village land holders to limit their tax liabilities can be interpreted as an ability to curb such influence.

We can see a similar pattern of constrained influence if we turn from ordinary maintenance of the intake works to its occasional reconstruction. The Shōryūjigawa intake was the largest, most technically complex and perhaps most strategic irrigation facility in the drainage basin. Its reconstruction every twelve years was undoubtedly the largest periodic assembly of labor and materials for irrigation purposes during the Tokugawa period. We are fortunate that a notebook (hikae) survives which was compiled by Kyūshichi and which details the course of the 1864 intake reconstruction project. The notebook is dated 1865 and combines diary-like entries and copies of relevant circulars and directives from domain officials. Additional documents (principally, project completion reports, dekimokuroku) concerning reconstruction in 1816, 1828, 1840, and 1852 have also been preserved by Kyūshichi's household.[50] From the 1865

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[50] The diary and other documents appear in S/S 1974:173-180, 184-190, 207-236, 254-259; some of these documents also are published in YKS 1980:672-675, 679-681. See the discussion in S/S 1974:198-206 and Kelly

Table 13

Distribution of registered land holdings, Kumaide area, 1853

village	registered land holding (koku) 1	1-5	5-10	10-15	15-20	20-30	30	total
Kumaide	9	33	31	14	1	1	2	91
Koya	3	6	1	0	1	0	1	12
Nishi-iwamoto	2	8	1	2	2	1	0	16
Katakai	1	4	9	2	5	0	1	22
Katakuki	3	8	15	5	0	2	0	33
Itaigawa	8	8	14	3	4	1	0	38
six village total	26	67	71	26	13	5	4	212
six village headmen			2		4			
contractors	2	2	3	2	2	2	0	13

Note: These figures are the number of households with total registered holdings in the above categories; they include non-resident landholders.

Source: S/S 1974:154-155

diary and these other records, the following points may be distilled.

(1) The purpose of the reconstruction project was the replication of the existing intake facilitiese Although there were minor differences in the dimensions of some of the logs and boards used in projects from 1816 to 1864, the only change in the actual dimensions of the intake works throughout these years was in 1840, when the downstream-side buttress was lengthened 0.91 meters to 12.84 meters and the height of the intake itself was raised from 3.64 meters to 3.91 meters. Neither change increased the intake volume.

(2) The time span of the 1864 project was about fourteen months, from an initial petition from the Kumaide ōsekimori to the rural magistrate's office in late November of 1863 to the final accounting by the ōsekimori in mid-January of 1865. Actual construction work, however, did not begin until March of 1864 and was concentrated in the spring and the fall. March was spent in locating and arranging for the purchase of trees for timbers for the new intake, cutting and hauling them to the intake site, and sawing them into timbers of the required dimensionse In April, sawing was completed, a work shed constructed, and the cut timbers prepared (soaked and dried).

In May, the channel in front and behind the intake was dredged. While this was considered part of the rebuilding project, it was actually normal maintenance because the intake and the main canal were used throughout the summer growing season. It was not until after harvest, in late October, that actual river diversion, intake demolition, and rebuilding began. This work extended through November, and on the first of December, the rural magistrate himself came up from the castle town with his various assistants for an official inspection of the completed project.e The ōsekimoriés work was not finished, however, for the financial accounting, payment, and reimbursement required most of December and January.

(3) The division of expenses, labor, and materials was complex, involving the six villages, all villages in the main canal service area, and the domain treasury (specifically, its public works account allotted among the several rural magistrates). Overall responsibility for coordinating and carrying out the reconstruction was assigned to the Kumaide six villages and their two ōsekimori, under the formal supervision of the rural magistrate's officee The cost of the materials used, however, was divided between the domain public works account, with which several of the larger timber pieces were purchased, and the six villages, which had to supply the remainder of the timbers and other materials like rope and matting. The three metagi timbers, which had to be cut from straight cedar trees with usable lengths of 11.7 meters and stump circumferences of about 2.4 meters, were always difficult to locate; they

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1980:370-378.

were generally found in shrine precincts and purchased from reluctant shrine priests. In 1864, although the reference is ambiguous (3.23 entry), it is possible that the rural magistrate intervened to order the requisition of all three metagi trees from a single shrine in Nakano-shinden Village, a settlement in the upper basin outside the Shōryūjigawa canal network (as were most the villages from which materials were purchased, there being few forested areas in the main canal service area itself). Kyūshichi apparently compromised with the Nakano-shinden Village officers and purchased only two metagi trees from them; he got the third from the Kumaide Village shrine.

Labor for the project was divided, at least formally, between the Kumaide six villages and all villages in the main canal service area. The latter were responsible for direct construction tasks: cutting saplings to be used for the side buttresses (300 saplings taken from the domain forest, calculated at one laborer per tree), dismantling the old gate and building the new one, and the channel dredging around the intake. The six villages handled all ancillary tasks, including cutting, transporting, and preparing all other timber, diverting and controlling the river water flow during the construction period, building the work shed, providing messenger runners, and so on. There are references for several of the years to a requisition of laborers from village groups outside the Shōryūjigawa service area, including those on the opposite bank of the Aka River, for dredging along the river; it is not clear, though, whether this was a special requisition for the intake project or whether it was an annual corvee duty.

While labor in principle was so divided between the Kumaide six villages and the main canal villages, in fact most work was done by workers from the six villages. That is, tasks to be done by the main canal villages had customary fixed labor quotas--for example, 300 workers for cutting and preparing the buttress saplings, 70 workers for the channel dredging, 580 workers for embankment repair, etc. Some negotiation was possible, as in 1864, when a meeting of the ōsekimori, main canal village officers, and domain officials decided that 700 workers would be needed for intake demolition and building, but generally, the limits were set by precedent. The important point, though, is that these 70, 580, 700, and 300 workers were rarely actually dispatched. Instead, a rice, and later cash, equivalent in wages was paid by the village group headmen of the main canal area to the ōsekimori, who then hired and supervised Kumaide area workers in the projects. These payments were shared by all main canal villages in proportion to their registered main canal paddy land acreage (mizukake tadaka). It is not clear when this arrangement began; it was used from at least 1816. It is clear that it could work to the considerable personal advantage of the ōsekimori, a point to which I will return below.

(4) Another feature of these projects which emerges from the documents is the tendency to carry out transactions (wages and material purchase) in

cash rather than in kind. Furthermore, there was a steady escalation of costs through the nineteenth century. In 1816, the two major timber purchases paid by the domain public works account (3 metagi and 23 front gate timbers) amounted to 53 kan in copper coin; by 1864, the same materials cost a total of 156 kan.

(5) While the project was nominally under the supervision of domain officials, concern did not reach beyond the rural magistrate's office in 1864. The magistrate himself made only two perfunctory visits to the intake, and most references in Kyūshichiės diary are to rural magistrate assistants. Even the assistants played a passive role. Their permission was secured at various moments and they made belated reimbursement for materials expenses, but they seem to have intervened only rarely in the project. The most direct reference is the entry of 11.30; Kyūshichi recorded that the assistant Matsuda became very angry at him because only 122 workers had shown up that day and he (Kyūshichi) was not handling the labor hiring satisfactorily. Of course, from Kyūshichi's standpoint, the fewer workers he hired, the more he and Gihachirō stood to profit, a situation Matsuda may have been cognizant of. The project itself ended that day, and the incident elicited no further references in the notebook.

(6) Within the framework of customary procedure and domain regulations (often one and the same), a certain measure of control had been appropriated by the two ōsekimori and by the village group headmen of the main canal service area. The basis of this control was not technical know-how; there are not references to construction difficulties or to the need for technical specialists. The design was fixed, and the carpentry and earth-moving skills required were probably general and transferable skills. Nor does materials procurement seem to have been a source of influence for the ōsekimori; in 1864, they actually paid slightly more for the metagi timbers than they were reimbursed by the domain.

Rather, it was their manipulation of labor that was important, a manipulation that depended on the cooperation of village group headmen and on a degree of control over local cultivators. Kyūshichi was fairly frank in his notebook about such manipulations. On November 13th and 19th of 1863, Kyūshichi met with officials of Daihōji Village Group (the village group headman) and Kyōden Village Group (the labor supervisor, who worked under the village group headman) to confirm that he would handle the embankment repair work associated with the intake project, and a figure of 580 workers was agreed upon. In fact, as Kyūshichi noted in hiseprivate accounting, only 382.1 workers were used; moreover, from the main canal villages he received wages of 160 mon per worker (times 580) but only paid out wages of 150 mon per worker. Thus, he (and Gihachirō) were paid a total of 92 kan 800 mon (580 workers times 160 mon) by the Kyōden Village Group headman. They paid out a total of 57 kan 315 mon in wages to the 382.1 workers plus additional expenses of 4 kan 780 mon for rice wine and dried fish for the workers. They then returned "privately" (uchi-uchi) 12 kan 800 mon to the Kyōden Village Group headman as well as small payments

of 1 kan 600 mon to three other village group headmen in the main canal service area. The balance of 13 kan 105 mon, roughly equal to the amount they returned to the Kyōden Village Group headman, was split between themselves. These arrangements were also true of the other intake tasks for which main canal villages were responsible. Because all accounting is not recorded in such detail by Kyūshichi, it is impossible to determine the total profit of the ōsekimori during the project, but on the basis of relative numbers of workers per task, I would estimate it to have been about 15~20 kan each.

In sum, these documents present a general view of the intake reconstruction project as circumscribed by customary procedures and formally carried out by a hierarchical role structure ranging from the water user-cultivators, who shouldered the tax and labor burdens, to the ōsekimori, who directed the work, and the rural magistrate, who supervised the ōsekimori. Domain financial support was substantial, though supervisory interference was minimal; domain officials had a potential power to intervene, but they showed little inclination to do so. It is of course difficult to judge whether intervention was unnecessary or they were unable to enforce unpopular orders. On the one hand, there did not appear to have been any attempts to alter the dimensions, design, or materials of the intake to increase intake volume during the nineteenth century. On the other hand, when Kumaide villages indirectly challenged domain procedent by shifting to the contractor system of intake maintenance in 1840, the domain did not try to intervene.

In the middle, between the water user-cultivators and the domain officials were the ōsekimori and the village group headmen, who found they could turn domain passivity to personal profit. In this sense, it was in their interest to support the customary procedures because this would insure continued lack of official interference.

Irrigation tasks along the main canal

Along the main canal itself, there were two important sets of tasks--maintaining and repairing the canal and allocating water at the intakes to the thirty-seven branch canals. The main canal required periodical dredging of the canal bottom as well as repairs to the earth canal banks, which could be washed out in high water or storms and weakened by vegetation growth and traffic. There was at least one annual dredging of the main canal, in the spring before field work began. It is unclear how labor was allocated in this dredging, but the Kumaide ōsekimori records suggest a tripartite division of the canal. Work at the top 1.1 km section of the main canal was done by about 1500 workers, drawn from all villages in the service area (known as mizu-shita ninsoku). Work in the mid-section of the canal was divided equally between labor recruited from all villages and labor recruited from only those villages

in the lower two-thirds of the main canal service area (termed jimoto ninsoku). Finally, dredging below this mid-section was done exclusively by those villages in the downstream area.

Labor requisitions seem to have been proportional to a village's (or perhaps village group's) irrigation acreage registered yield. Unlike intake reconstruction, labor (rather than a cash equivalent) was actually supplied by all villages. Requisition arrangements may have been organized by the village group labor supervisor (waritsuke), and the actual work supervised by the Kyōden ōsekimori, but this is conjecture.

By contrast, repair work on the canal banks was evidently handled through the domain public works procedures. That is, upon petition from a village headman through the village group headman, the rural magistrate approved a repair project and channelled public works funds for the hiring of workers.

As we noted earlier, by the early 1700s, the two Kumaide ōsekimori, previously subordinate to the two ōsekimori from the Kyōden area (in the mid-section of the service area), came to have direct responsibility for all intake matters under the rural magistrate's office. While the Kyōden ōsekimori role continued, its duties were less clear and its authority much attenuated compared to that of the Kumaide ōsekimori. Most documents of main canal matters contain no reference to the Kyōden ōsekimori.

Allocation of main canal water to the branch canals was the second critical delivery task along the main canal, and here there were three distinctions of importance. The first concerned the design of the branch canal intakes themselves, which varied widely with the use or elaboration of one or more of the following structural elements (see Figure 5 for a schematic illustration):

a. sekine ("canal base"). This was a stone and/or board lined section of the main canal just below the branch canal intake. The lining fixed the main canal width at that point. It was also termed a sekidai.

b. makura ("pillow"). This was a weir of boards, logs, stones, and/or bags of earth laid across the main canal sekine. It raised the water level of the main canal flow, increasing the flow into the branch canal.

c. sadame kui ("measuring pole"). This was a notched wood pole planted upright in the middle of the main canal sekine either above or below the makura. It thus served to measure the level of the water flowing downstream in the main canal.

d. sekiguchi ("canal mouth"). This was the cut in the main canal bank above the sekine to the branch canal. For a few large

branch canals, intake was regulated by a gate (suimon) of fixed structure and dimensions. More commonly, regulation was by boards laid horizontally across the canal mouth and supported by vertical poles; such an intake was called a mido (written with the same characters as suimon), hence the alternative to sekiguchi, midoguchi. At some intakes, only bags of earth and/or stones laid at the mouth served to regulate volume.

e. otoshi ("spillway"). There was sometimes a spillway channel just below the intake along the branch canal to lead excess water back to the main canal. It was occasionally gated (harai-suimon).

Each of these structural elements--their presence or absence, their dimensions, and the construction materials--could be used to regulate water flow and measure the division of water between main and branch canal.

A second distinction was between two allocation 'states'--normal and special. Under normal allocation (jōsui or heisui), there was constant water flow in the main canal and water was diverted to the branch canals in proportion to the dimensions of the branch canal's intake. A second allocation state, special allocation, was instituted in the spring during field preparation and transplanting (when there was a heavy demand for a short time period) and in the dry summer months when there were shortages. There were three methods which could be used in special allocation:

a. bansui. This was a rotational allocation among the branch canals based on a time schedule.

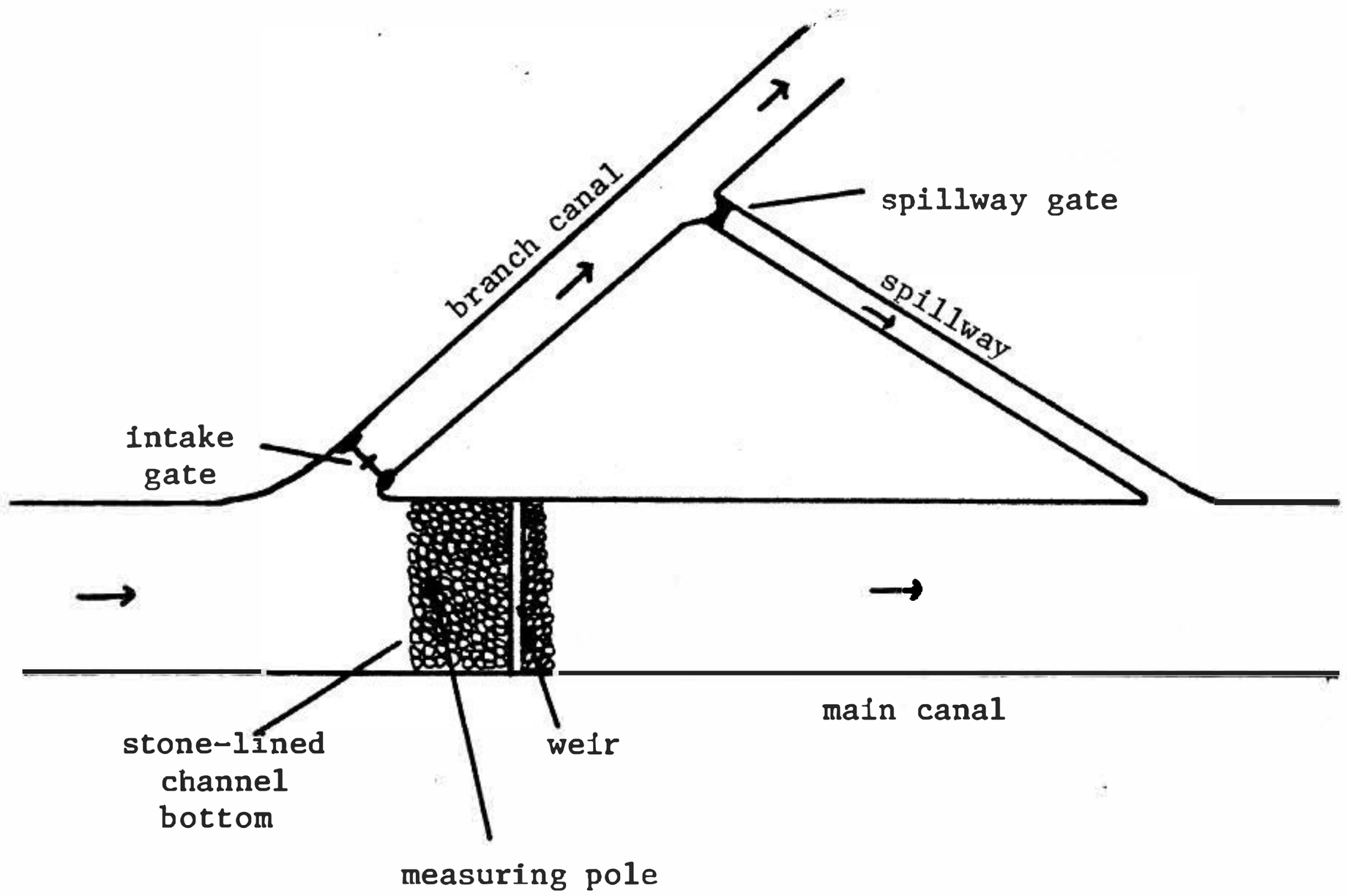
b. bunsui. This was allocation proportional to the acreage or registered yield (expressed as either kokudaka or the older karidaka) of the branch canals.

c. tōshi-mizu. This was a special allocation of a timed volume of water to downstream branch canals, accomplished by lowering or removing the diversion weirs of the upstream branch canals for a fixed period of time. It was also called mido yaburi.

Of course, allocation proportional to acreage or yield (bunsui) was implemented with a timed rotation, but this can be distinguished from rotational allocation (bansui) which was based on time schedules of customary usage but which did not necessarily reflect acreage or yield proportions.

Finally, a third distinction of relevance to allocation was that between yōsui ("irrigation water") and morai-mizu ("received water"). Yōsui was water delivered through a canal network to its official service area, which we will see in the case of Shōryūjigawa to have been those

Figure 5: Schematic drawing of structural elements of branch canal intakes



branch canals and villages on the 1658 registry; it was 'full-rights' water, the water delivered to those branch canals, villages, households, or paddy field parcels (depending on the unit holding the water right) with full use rights and maintenance responsibility. In contrast, morai-mizu was the drainage (sute-mizu or akusui)[51] or surplus water (josui) of a unit (branch canal, village, household, parcel) with rights to yosui, use of which was granted by special agreement to a unit without such rights.

I have derived these allocation distinctions from an inspection of Shōryūjigawa materials in S/S (1974) and Shōryūjigawa Irrig Coop (1937). How they were actually applied is the subject of the remainder of this section as well as the following section on irrigation at the branch canal level. It should be noted, though, that they were also the relevant distinctions in the Nakagawa and Inaba networks and resembled distinctions used in other areas of the Tokugawa state (for example, see Tsuchiya 1966:85-111).

The thirty-seven branch canals of the Shōryūjigawa network served paddy lands in a total of eighty-seven villages. Each branch canal served from one to fourteen villages; the mean was 3.6 villages per branch canal. From another perspective, the great majority of villages (58 of 87) were served by a single branch canal. Most of the remaining 29 villages had lands in two branch canals; they were generally in the upstream area where branch canals were shorter.

As seen in chapter two, large increases in registered acreage in the second decade of the seventeenth century indicate that the main canal was in use soon after its construction, and we know that by 1658, thirty-six of the thirty-seven branch canals were in operation. It was in 1658 that a registry was prepared which listed each branch canal in order from upstream to downstream with the amount of paddy land in its service area expressed in koku and itemized by administrative village. This document, known as Kumaide ōguchi yori mizukake tadaka mokuroku (Registry of Paddy Land Yields of [Land] Irrigated from the Great Kumaide Intake), became the basic irrigation document for the Shōryūjigawa network. It survives as a written listing and a crude map of the main canal, dated the twenty-fifth day of the sixth month of 1658 (reproduced in Shōryūjigawa Irrig Coop 1937:35-52 and S/S 1974:24-35). The nature of the registry, however, remains somewhat of a mystery, and by whom and under what circumstances it was drawn up is not known. At least one copy was kept by the Kyōden ōsekimori, but their role, and more importantly, the role of domain officials in making up the registry is unclear.

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[51] Akusui could also mean "excess water" and even "flood water," but here it referred to field drainage.

Because those were years of rapid expansion of paddy acreage in the main canal service area, it is reasonable to speculate that the registry was an attempt to specify and so protect existing claims to main canal water. A service area figure known as mizukake tadaka, "irrigated paddy land yield total," was noted for each branch canal and for each administrative village within the branch canal (see Table 14 for a listing of branch canals and Table 15 for a listing of administrative villages). This figure, expressed in terms of putative yield, represented the amount of paddy land registered within the main canal service area, but it corresponded neither to actual acreage nor, often, to the domain muradaka.

Dispute documents throughout the period demonstrate that appearance on this 1658 registry legitimated claims by branch canals and villages for main canal water--that is, claims to Shōryūjigawa yōsui. At the same time, two features of the registry fueled many of the allocation disputes. First, it contained no explicit statement of the principles by which Shōryūjigawa water was to be allocated among the branch canals and villages; it was cited in support of claims for proportional allocation by registered yield and also in support of allocation by "customary branch canal dimensions." Because these dimensions were not included in the registry, ambiguity was compounded. Second, the 1658 figures came increasingly to vary with actual branch canal and village service areas as paddy land expansion continued differentially through the main canal service area. In brief, the 1658 registry was useful to main canal irrigators in enumerating the branch canals and (within the branch canals) the administrative villages with rights to main canal (yōsui) water, but it proved an ambiguous and unreliable standard for allocation among these 'legitimate,' registered users. There are at least partial records of problems and conflicts concerning allocation of main canal water for the years 1726, 1741, 1753, 1768-71, 1794, 1798, 1809, and 1824. Each of these cases will be briefly outlined; following this, several generalizations about these allocation difficulties will be proposed.

The first problems for which records survive arose in 1726, when midstream villages (roughly branch canals #13-#18) complained to domain officials of water shortages (S/S 1974e 38-41). The officials in response ordered two changes in main canal arrangements. First, the registered irrigation acreage yields were reduced for eight of the branch canals, generally upstream of the petitioners. These were minor reductions, one result of which was to reduce the total main canal service area figure by 2.3%, from 26,036.4092 koku to 25,433.2872 koku; they may have been intended to correct redundant entries on the 1658 registry. The second change was in the order of some of the intakes to some of the branch canals between #7 and #17. Generally speaking, the left bank branch canals tended to move ahead upstream in position at the expense of the right bank branch canals. For example, Kuranowaki moved ahead of Kawaguchi, Terada moved ahead of Minde and Takazaka, etc. (see Kelly 1980:305).

Table 14

Branch canals of the Shōryūjigawa Main Canal

branch canal name	1658 registry intake order(1)	registered yield	no. of villages	changes in registered yield in 1726 document
[no name recorded]	1	34.1 koku	2	---
[no name recorded]	2	300.0	1	---
Uchi River(2)	-	--	-	---
Araya	3	13.0	1	---
Sekiguchi	4	241.4	4	reduced 92.6 to 148.8
Takahashi	5	110.0	3	---
Yudono	6	207.0	8	---
Maruoka(3)	7	1199.4	8	---
Bizen(4)	8	173.0	3	---
Kawaguchi	9	75.8	4	---
Kuranowaki	10	2896.5	14	reduced 300 to 2596.5
Minde(5)	11	688.0	4	---
Takazaka(6)	12	851.0	3	---
Terada	13	936.6	3	---
Dōgata	14	320.4291	2	---
Yoka-chō (Sokohi)	15	60.0	1	---
Shinmachi	16	716.79	4	---
Chiyasu(7)	17	1551.2986	7	reduced 49.9202 to 1501.3748
Hayashizaki	18	1946.1001	7	reduced 55.2741 to 1890.826
Niigata(8)	19	512.5459	4	reduced 121.1675 to 391.3784
Takadamugi	20	2166.4480	9	---
Hongō	21	2225.2060	6	---
Hodashi	22	715.47	2	---
Harima	23	1510.5430	3	reduced 60 to 1450.5430
Naka-kyōden	24	1219.6554	3	---
Zennami	25	1340.8191	5	reduced 463.1271 to 877.692
Aoyama	26	2424.5560	4	reduced 30 to 2394.5560
[Narita](9)	26A	339.72	1	
[no name recorded]	27	460.0	1	---
Nishi-araya	28	41.5	2	---
Nakamura	29	55.0	1	---
Kami-katsuramata	30	296.0	3	---
Kami-yamazoe	31	53.6	1	---
Toriesa-shima	32	235.5	3	increased 6.5 to 242.0
[no name recorded]	33	65.0	2	---
[no name recorded]	34	27.0	1	increased 200 to 227 (?)
[no name recorded]	35	200.0 (?)	2	combined with #34 (?)
Kami-tonoshima	36	130.0	2	---
[no name recorded]	37	100.0	1	---

Notes:

1. This is the order of intakes from upstream to downstream. #1 to #26 were along the Shōryūjigawa Main Canal itself, while #27 to #37 were along the Uchi River. These numbers are used to identify branch canals in Map 6.
2. After the two most upstream intakes, the Uchi River branched from the Shōryūjigawa Main Canal.
3. This was later known as Kami-nakashima Branch Canal.
4. This was later known as Maruoka Branch Canal.
5. This shared a diversion weir in the main canal with Terada Branch Canal in 1726.
6. This shared a diversion weir in the main canal with Shinmachi Branch Canal in 1726.
7. This was also known as Antan Branch Canal.
8. This was also known as Kayabara Branch Canal.
9. Narita Tertiary Canal was not listed in the 1658 registry but it did appear on the accompanying map as a branch of Aoyama Branch Canal.

Table 15

Administrative villages in the Shōryūjigawa Main Canal service area

village	branch canals served by	registered yield on 1658 registry
Higashi-araya	(#) 2,27	760. koku
Nishi-araya	1,3,28	42.3
Katakuki	1	25.8
Sekiguchi	4,5,6,7,8	250.
Yudono	4,5,6	183.
Takahashi	4,5,6	118.4
Ousui	4,6,28	52.3
Nakasui	6	57.
Maruoka	6,7,8,9	250.
Bizen	6,8,9	100.
Kami-chūshima	7	273.8
Shimo-chūshima	7,30	296.9
Toriesashima	7,32	154.8
Kawaguchi	7,9,11	140.
Nakamura	7,29	189.
Oribashi	7,34	162.4
Shioda	9	29.8
Shōryūji	11	90.
Urushibara	11	66.
Minde	11,12	900.
Takazaka	12	401.
Komaki	12	50.
Kami-katsuramata	30	85.
Shimo-katsuramata	30	180.
Kami-yamazoe	31	93.6
Shimo-yamazoe	32,33,35	200.
Shinshū	35	150.
Kami-tonoshima	36	30.
Shimo-tonoshima	36	100.
Yoka-chō	15,37	160.
Sakai-kōya	10	86.8
Naganuma	10	101.5
Kenukibashi	10	88.
Nakano	10	39.8
Ōyodogawa	10	445.
Koya	10	54.
Terada	10,13	677.
Bande	10	433.
Yamada	10	411.4
Shirayama-hayashi	10	95.
Zenryūji-shinden	10	42.
Inooka	10	700.

Yamaya	10	150.
Akasaka	10	50.
Koyodogawa	13,16	334.
Yanagida	13	170.
Daihōji	20	170.
Shimo-daihōji	19	323.4291
Niigara	14,18,19,21	190.6980
Shinmachi	16	449.
Saitō-kōya	16	40.
Nunome	16	183.39
Nakano-kyōden	17	347.703
Hira-kyōden	17	435.442
Tanba-kōya	17,18	173.7929
Abe-kōya	18,20	108.804
Sangen-zaike	17	187.0572
Chiyasu	17	167.7343
Matsui-shinden	17	41.5392
Hayashizaki	18	991.8860
Nishi-kyōden	18	400.1020
Takadamugi	18,20	556.5499
Daibe-kyōden	18	282.282
Chihara	19	364.203
Hōdashi	19,22	640.47
Rinda	20,21	353.38
Kita-kyōden	20	282.121
No-kōya	20	346.91
Urushijima	20	60.253
Shin-kōya	20	267.554
Shobunuma	20	138.433
Hongō	21,23	583.626
Kakuganji	21	348.753
Ko-kyōden	21	557.16
Arai-kyōden	21	760.667
Hōdashi	19,22	640.47
Yunozawa	22,24,25	600.4615
Harima-kyōden	23	1420.543
Naka-kyōden	24	866.2754
Kakuda-futakuchi	24	153.18
Zennami	25	410.609
Higashi-nonuma	25	467.083
Aoyama	26	917.769
Inoko	26	1062.8
Tenshindō	26	330.476
Obana	26	113.511
Narita-shinden	26	339.728

Note: The branch canal numbers refer to Table 14.

Sources: Shōryūjigawa Irrig Coop 1935:35-52, S/S 1974:24-34.

Although it is not entirely clear from the 1726 map, references in a 1732 document make it highly probable that these changes (and the water shortages that prompted them) arose from the development several years earlier of an area of swamp land (Kimura Yachi) between the villages of Kimura, Yase, Shiroyama, and Shiomizu (ibid.:41)e This was upstream of the Kyōden villages, adjacent to paddy land irrigated by Minde and Takazaka Branch Canals. The swamp land was developed by a Tsuruoka rice wine merchant, Miura Nibei, who had received permission from the domain in 1720. This was the same year that the contract system of public works was instituted by the domain, a system in which the castle town merchants were quite active.

The first survey of the new paddy lands in 1724 registered 16 chō (about 15 hectares).[52] A canal was constructed for water delivery-- Kimura seki-- but it never appeared on the main canal registry or maps during the domain period. However, an 1885 map includes Kimura kakehi (flume) and notes for it a service area of 851 koku; this total is broken down as Takazaka Villagee= 401 koku, Minde Villagee= 400 koku, and Komaki Village = 50 koku. This total is the same as the domain period total for Takazaka Branch Canal. Satō and Shimura (1974) surmise that Miura managed to extend channels from Takazaka and Minde Branch Canals for a water supply. In time, at least one of these channels became known as Kimura Flume, though it was never officially recognized in the domain period.

This incident illustrates several points. It was most difficult, indeed impossible, to construct a new branch canal directly from the main canal; the only strategy available for development was to attempt to extend an existing branch canal. In the case of the Kimura development, this was possible perhaps because of close relations between the Tsuruoka merchant and domain officials, perhaps too because it was still somewhat early in the land development process. Even so, problems--or at least complaints--arose, and the domain attempted a compromise solution. Its decision in 1726 was to reduce downstream registered yields slightly and to allow several of the Kyoden area branch canals to move their intakes upstream above Takazaka and Minde Branch Canals.

In August of 1741, another complaint petition reached the domain authorities, this time from the headmen and residents' representatives of eleven villages with lands serviced by the downstream branch canals (roughly #20 through #26; S/S 1974:71-75). They claimed that no water was reaching their branch canals and requested (i) that the domain organize a special tōshi-mizu allocation and (ii) that it have a measuring pole (sadame-ki) put in at the Aoyama Branch Canal division point. Aoyama was the last branch canal along the main canal, and the request for the measuring pole was perhaps to provide some official evidence of the volume

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[52] The rate of expansion of paddy land in this swamp land is not known but as the present-day acreage is 137 hectares, there was obviously considerable margin (see Kitamura 1956 for further details).

of main canal water reaching its lowermost branch. The measuring pole request was apparently rejected, but the domain did try to arrange a special allocation to the downstream branch canals by ordering the upstream branch canals to allow water to pass (mizu-sage), presumably by temporarily lowering or removing their diversion structures. The downstream villages continued to complain that no water (or insufficient water?) was reaching them. Unfortunately, lack of further documents prevents us from tracing the dispute beyond this second complaintd.

The incident does suggest, though, that it was domain officials, rather than the Kyōden ōsekimori, who had the authority to arrange special allocations of main canal water. At the same time, the continued complaints of the downstream villages raise doubts about the effectiveness of that authority and/or the effectiveness of the special allocation measure.[53]

A 1753 inspection record entitled Kyōden-kumi Yodogawa-kumi ōseki kenbun-sho (A Record of an Inspection of the Main Canals in Kyōden and Yodogawa Village Groups) contains the earliest surviving data on intake dimensions and water flow. The record was part of a notebook (hikae) of the Kyōden area ōsekimori Jiroemon, but neither his role in the inspection nor the time of year is clear from the surviving portion of the document. Furthermore, rather ambiguous descriptions of only sixteen of the branch canal division points are given (see Table 16; the sixteen are the branch canals #10 through #26 along the main canal, with the exception of #12, Minde).

The inspection record does illustrate, however, the structural variation in the design of the branch canal intakes. Generally, #10 through #18 were two-gated intakes,dand at the time of inspection, only one side was open. The four intakes below #18 (Hayashizaki) had no gates, while the four tail-end intakes were but single-gated. Most of the intakes also had spillways, channels just below the intake which led excess water back into the main channel, and they were reported to be open, half-open, or closed. Where open, the water depth measurement appears to have been made in the branch canal below the spillway.

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[53] An interesting feature of this case was that the eleven petitioning villages were all shogunate-territory villages, and following administrative procedures, they presented their petition to the Ōyama shogunal office, which forwarded it to (probably the rural magistrate's office of) the domain. Although S/S, who discuss this petition (1974:71ff.), interpret this as a case of shogunate versus domain villages, I find little evidence in the case to support that. These villages were frequently aligned with other downstream villages under domain administration, and the issue much more clearly divided upstream branch canals and downstream branch canals.

Measurements and instructions in Shorujigawa Main Canal inspections

Summary of measurements[1] and instructions in the main canal inspections of 1753, 1794, and 1824

Branch canal (1726 order)	1753 inspection: intake width	1753 inspection: water depth (branch canal)	1753 inspection: intake structure	1794 inspection: main canal width	1794 inspection: adjustments ordered	1824 standards[2]: main canal width	1824 standards[2]: depth of water flowing over *makura*
#9 Kuranowaki	2.1	0.74	*midoa*[3], 1/2 open spillwaya(?)	9.9	remove 8-9 bags of fill from top of main canal *makura* weir	11.7	1.3
#11 Terada	1.5	0.74	*mido*, 1/2 open spillwaya(?)	(10.8)[4]	none	9.9	1.1
#13 Takazaka	1.9	0.12	*mido*, 1/2 open spillwaya(?)	not noted	take out two large stones from main canal bottom; level out fill bags which form top of main canal *makura*	not noted	not noted
#14 Shinmachi	1.8	0.15	*mido*, 1/2 open no spillway	7.8	close off 1/2 of branch intake with boards	9.6	1.2
#15 Dōgata	1.7	0.12	*mido* no spillway	(10.8)[4]	level out fill bags on top of main canal *makura*; cut away small brush in main canal	10.8	1.3
#16 Chiyasu	1.8	0.51	*mido*, 1/2 open no spillway	6.9	same as #14	8.7	1.4
#17 Yoka-chō	1.1	0.30	*mido* spillway, 1/2 open	(10.8)[4]	none	not noted	not noted
#18 Hayashizaki	1.5	0.09	*mido* no spillway	8.0	close off 1/2 of branch canal intake with fill bags	10.8	1.2

Table 16 (cont.)

#19 Niigata[5]	2.4	0.24	no gate structure no spillway	8.1	place fill bags at intake according to verbal instructions	9.0	1.2
#20 Takadamugi[5]	2.3	0.51	no gate structure no spillway	6.8	same as #19	7.8	1.1
#21 Hongō	2.1	0.99	no gate structure spillway, 1/2 open	(10.8)[4]	same as #19	6.9	1.4
#22 Hōdashi[5]	1.8	0.27	no gate structure no spillway	5.1	same as #19	6.3	1.5
#23 Harima[5]	1.4	0.36	mido no spillway	5.6	none	7.2	1.1
#24 Naka-kyōden[5]	1.7	0.54	mido no spillway	(9.0)[4]	none	7.8	1.5
#25 Zennami[5]	1.4	0.17	mido no spillway	(9.0)[4]	none	7.5	1.3
#26 Aoyama	1.8	0.64	no gate structure spillwaya(?)	not noted	none	no standards set for #26	

Notes:
1. All measurements are in meters.
2. These 1824 standards are taken from an 1885 map which indicated that these standards had been established in the fourth month of 1824 by the Daihōji Village Group headman and in force since that time without change.
3. See text for explanation of mido gate.
4. The main canal width was apparently not measured at these intake points. Rather, the "customary width" was recorded instead.
5. The 1753 inspection record included the notation "insufficient water" for each of these branch canal intakes.

Source: S/S 1974:92-94, 98-101

The record is also interesting for its notation of actual "water flow." This was not a timed volume measurement but simply a calculation of the branch canal intake width times the measured water height in the branch canal (listed in Table 16). Unfortunately, this is not very useful; not knowing the water velocity (which will vary among division points), we cannot really compare the amount of water available to each branch canal. It is also difficult to reconcile the water flow measurements with the notations on the report that six of the eight most downstream branch canals were receiving an "insufficient" water volume. This was no doubt the crux of the investigation--downstream shortages--but the data of the written report shed little light on this problem. One might surmise from the report a more general difficulty in expressing relative volumes with precision.

Increasing water flow tensions along the main canal are documented by a series of petitions and counter-petitions from the years 1768-71.[54] This was aggravated by worsening conditions along the Aka River near the Kumaide intake--especially the accumulation of debris and sediment, despite annual dredging of over 1000 worker-days and intake reconstruction requiring 4-5000 worker days. In the fall of 1768, villages throughout the main canal service area had petitioned through the village group headmen to the domain[55] for a project that would re-channel the Aka River at Kumaide, but this was not approved.

Then, in late August of 1770, a petition reached domain officials from seven downstream villages (shogunate-administered villages), complaining strongly of water shortages and asking for water allocation to the branch canals in proportion to their registered yield (sō-sekiko mizudaka o motte bunsui) (document #2). As a solution to their immediate shortages, they joined with five domain-administered downstream villages to request twelve days of special allocation (tōshi mizu) (reference to this in document #3). Neither request was approved.

In the spring of the following year, just before spring field preparation, these twelve villages again petitioned the domain, arguing that the upstream branch canals were taking in water freely and 'selfishly,' without respect to customary levels (document #3).[56] They

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[54] These are reproduced in S/S 1974:79-87 and are numbered 1-12. In the following discussion, they will be cited by these numbers.

[55] Again, the domain official is not identified. The reference here is to the "Tsuruoka Domain Office" (Tsuruoka oyakusho). At other times, the term "Riverbank Domain Office" (kawabata oyakusho) is used, as the office where both district deputy and rural magistrate officials conducted business was located beside the Uchi River in the castle town.

requested that stricter allocation be applied to all branch canals and that, as a one-year experiment, the upstream branch canals refrain from setting up a permanent structure in the main canal at their intakes. That is, a diversion could be constructed for the spring season (referred to as a haru makura), but they asked that during the summer dry season the domain limit the number of days they could maintain a diveersion weir (a natsu makura) so as to insure water reaching the downstream branch canals.

This proposal was apparently circulated among the several village groups because it inspired a number of counter-petitions from upstream villages. Two of them, signed by a total of nineteen villages spread among midstream branch canals from Shinmachi (#15) to Hōdashi Branch Canal (#22), argued that the plan would constitute a change in traditional procedures and that because each branch canal had a number of tertiary laterals, it would cause water shortages in their service areas (documents #6 and #7). Another petition was sent in by four shinden villages on the west bank of the Ōyama River. They had been developed at the end of the 1600s and were not on the 1658 registry; rather, they depended on the morai-mizu from several midstream branch canals, and they complained that they would be severely jeopardized by such a plan (document #9). They countered with a request to the rural magistrate that they themselves (and their 2700 koku of paddy lands) be added to the registry!

This last request was dismissed, as was the original proposal for the one-year experiment (document #5). The domain officials said there was no consensus among themselves and the village group headmen so they would simply inspect the branch canal intakes to ascertain the situation.

This was hardly satisfactory to the downstream branch canals (specifically, the tail-end four: Harima, Naka-kyōden, Zennami, and Aoyama Branch Canals), and in July of 1772, another grouping of thirteen downstream villages tried a new tack. They asked for improvements to the main canal intake at Kumaide (document #10). In 1761, the intake had been moved slightly upstream, and the thirteen villages argued that this had only worsened the flow because large rocks and silt now repeatedly blocked the intake. They complained that since then, it was necessary to send up several thousand workers two or three times a year for emergency repairs. However, for unknown reasons, upstream villages opposed this request as well.

The downstream thirteen villages then countered with a request that the intake at least be widened. This drew strong opposition from the Kumaide villages, which claimed that the intake had been moved upstream because its embankment had been breached by flooding (that is, moving it upstream

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[56] This appears to be a re-petition of a request made previously in late 1769 or early 1770, because the subsequent counter-petitions are dated either February or March of 1770.

would decrease the intake angle between the Aka River and the main canal and thus relieve pressure on the downstream channel bank of the main canal, which seems to have been what was breached). They said that to widen the intake would endanger their lands because of the great danger of flooding with increased volume, and they noted that, anyway, land around the old intake site had been eroded away by the river (document #11). The Kumaide arguments prevailed.

Finally, frustrated in every attempt thus far, the downstream villages called for the dismissal of one of the Kumaide ōsekimori, Kihachi; they claimed that in contrast to his predecessors, he never made any inspections of conditions along the main canal. No domain response is documented, but in 1775, Kihachi was ordered to leave his native Kumaide and the ōsekimori post was given to Sajiemon, the head of a branch household. This, if indeed it materially improved conditions along the main canal, would be the only action of the domain favorable to the tail-end villages during this period in the early 1770s.

Difficulties continued for the four tail-end branch canals in subsequent years, and three documents from 1794 reiterated several familiar complaints, while also reflecting a more coordinated and aggressive posture. On the thirty-first of July, 1794, a number of headmen from villages in these four branch canal service areas met to discuss the growing drought conditions. There had been continued sunshine from July 2 to July 12; despite a rainfall on the evening of the 12th,e rainless, sunny days had continued from July 13 through the day of their meeting. What had appeared to be a good crop was seriously threatened.

When the meeting broke up, four of the headmen went up to Kumaide to inspect the intake and found the volume flowing in from the Aka River to be quite low. At the same time, two others had gone up along the main canal itself to investigate the upstream branch canal intakes. They found that even if the river volume were increased, it would not reach their downstream areas because the diversions in the main canal to the branch canals of Daihōji (i.e., Dōgata), Chiyasu, Hayashizaki, Takada, Hongō, and Hōdashi were built up very high. They claimed that these branch canals were taking in their normal volumes of water (jōsui) despite the drought conditions.

These observations were included in a petition sent to the domain officials the next day (S/S 1974:91-2, document #1). A second document[57] described conditions at three of the upstream intakes in more detail. They reported that at Hongō and Takada Branch Canals' intakes, the diversion weir was too high, there were no intake gates nor spillways in

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[57] This second document is entitled kōjōsho-oboe (or kuchi-age kaki oboe), a document of 'testimony,' while the first was in the form of a petition (that is, "osorenagara...").

the branch canals, and the branch canals themselves were too wide and too deep. At Hayashizaki Branch Canal in recent years, over one shaku of water was being diverted through the use of logs and straw mats--despite a "fixed limit" (sadame-hō) of 0.3 shaku (ibid., pp. 94-6, document #3).

Thus, the downstream villages made three requests: (a) that the diversion weir set out across the Aka River at the Kumaide intake be extended by five frame units all the way across the river; (b) that a special allocation of tōshi-mizu be ordered; and (c) that the domain officials inspect and lower the intakes of branch canals that were drawing too much water.

This was received by the rural magistrate on the following day (August 2). He consulted with several village group headmen and, on the tenth, issued orders agreeing to the second and third requests. He rejected the first, calling such an extension of the Aka River diversion weir unprecedented.[58]

On August 9, three village group headmen and two assistants of the rural magistrate conducted the inspection of the intakes from Takazaka Branch Canal down to Harima Branch Canal, and on the fifteenth, they met with "both ōsekimori" (probably the two Kyōden ōsekimori) at the home of the Hongō Village Group headman to issue instructions (goshihō) for alterations at the intakes (ibid., pp. 92-4, document #2).[59] At Takazaka, Kuranowaki, and Dōgata intakes, they were ordered to remove large stones and/or sand bags that had been placed in the main canal to raise the water level. At Shinmachi, Chiyasu, and Hayashizaki intakes, they were either to close off one side of the intake gate or to pile sand bags at the gate entrance to reduce the intake flow. And, at Yoshihara, Takada, Hongō, and Hōdashi intakes, where the gates to the branch canals were only half-open, they were to pile sand bags in front of the intake to reduce the flow further. No specific instructions were written down concerning precisely how much flow to these branch canals was to be reduced (directions summarized in Table 16).

Four years later, 1798, again found the same downstream villages petitioning the domain. This time they complained that shortages were being caused by water seepage and canal bank deterioration along the main canal, and they asked that the domain sponsor a project to make the

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[58] In responding, he cited the formula discussed earlier, that seven parts of the Aka River flow was Shōryūjigawa's (further divided 5:2 between the main canal and the Uchi River) and three parts was for downriver main canals.

[59] There is a brief passage to the effect that these orders were presented to a meeting of village officials from whom agreement was obtained ("nattoku itashi").

necessary repairs. This was in fact ordered by the domain but was not carried out because of lack of agreement (among villages?) about the requisition of workers. They repeated the request in subsequent years but it was always postponed.

Then in late June or early July of 1809, the headmen of thirty-three villages in the downstream areae again petitioned the domain through the Daihōji Village Group headman (ibid., pp. 96-7, document #4)e They complained that the main canal was in very poor shape, with large rocks and sand deposits filling the bottom, eroded and caved-in channel banks, and vegetation growth on the banks. The effect, they claimed, was continual water shortages and usual harvest losses of 10-20%. The petition recounted that following transplanting earlier in June, a large crowd of farmers from eight villages in the tail-end three branch canals went up to the Kumaide intake and "had an argument" (monoii tsukamatsuri sōrō) with the two Kumaide ōsekimori; they demanded their removal, though the ōsekimori replied that the problem was that the condition (kawa-gata) of the main canal had worsened. The farmers were not convinced the ōsekimori were blameless, and the petition wondered what might erupt if domain attention was not forthcoming. It concluded with a plea for domain-sponsored repair work within the year.

Unfortunately, the outcome of this plea is unknown. The only subsequent document shows that in 1824, the domain officials once again took up the question of main canal allocation. On the basis of investigations by the Daihōji Village Group headman "and others," an "allocation formula" was issued which specified certain dimensions for fourteen branch canal diversion points, from Kuranowaki Branch Canal to Aoyama Branch Canal (document reproduced in ibid., pp. 101-2, summarized in Table 16).

The 1824 standards were at once more uniform and simpler than previous attempts. For the fourteen branch canal diversions, two dimensions were specified: the width of the main canal at that point and the minimum height of water flowing over the diversion weir down the main canal. It thus avoided the complications involved in trying to regulate the dimensions and operation of the variety of branch canal intakes found along the canal. Using a measuring pole, maximum intake volume could be regulated by checking the width of the main canal and the difference between the main canal water level and the height of the diversion weir.[60] These standards were in effect through the remainder of the Tokugawa period (there were minor changes after that, in 1885 and 1921).

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[60] The figures for the width of the main canal were generally 1.5 m to 2 m wider than those for 1794, suggesting that it may have been widened in the interim; the difference, however, might just be due to more reliable measurement.

These represented the first uniform, measurable allocation standards for which evidence remains. Even so, we have no way of knowing the relationship between the intake volumes and the service areas of the branch canals, either registered or actual. There is no record of the allocation principle used, if any, in establishing the dimensions, nor without knowing such data as the grade of the canal bed at the intakes can we calculate the actual intake volumes. The domain officials may have intended by these standards to insure some type of proportional allocation or they may have intended simply to establish dimensions which were easier to ascertain and less contestable than previous standards. We cannot judge from the surviving documents. (It may be added that the new dimensions defined permissible intake volumes only for normal allocation and no guidelines for special allocation states were included.)

While the partial nature of surviving data precludes a conclusive discussion of main canal matters, several generalizations may be attempted. First, as with other aspects of irrigation, domain officials were involved in the performance of most tasks along the main canal. Channel and canal bank maintenance and repair, rebuilding of diversion point structures, and water allocation to branch canals brought together several levels of roles. The rural magistrate and his assistants received requests and coordinated decision-making about allocation, while the district deputies decided requests for domain assistance for repair and rebuilding. The village group headmen appeared to play consultative and mediating roles in allocation disputes. It was frequently remarked that petitions received by the rural magistrate were circulated among various village group headmen for comment, but lack of records of such comments and debate makes it impossible to decide whether the village group headmen tended to represent the interests of villages under their jurisdiction or whether they reflected domain priorities for settlement of the dispute (rather than judgment of action or injury).

The role of the two Kyōden ōsekimori appears to have been subordinate and attenuated when compared to that of the Kumaide ōsekimori. They perhaps supervised maintenance and repair projects, but they had no decision-making authority. An investigation of intake division points was typically conducted by rural magistrate assistants and several village group headmen; the ōsekimori were then informed of adjustments to be made.

Interestingly, it was the administrative village--or more typically, a group of such villages--that was the unit which initiated most allocation petitions. For example, in the early 1770s disputes concerning the water shortages of the three tail-end branch canals and the alleged over-drawing of water by the eight branch canals upstream of these, petitions were drawn up jointly by numbers of villages. The issue was discussed in village meetings, and the written petitions signed by the headmen. Rarely did the groupings correspond exactly to branch canal service area divisions. Even where a formal and named branch canal organization

existed, it apparently had no standing as a petitioning body. This reflected the tendency for irrigation matters on the main canal level, as with the intake and the river levels, to be handled through the channels of general domain administration.

Although the complaints in 1798 and 1809 suggest difficulties in enforcing labor obligations, allocation was not surprisingly the most difficult and conflict-laden task along the main canal. Not surprisingly, too, such conflicts pitted upstream users against downstream users; claims of historical precedence, by contrast, were never at issue. It is actually more precise to identify a tripartite alignment of the thirty-seven branch canals--upstream, midstream and downstream. The first group included roughly the top nine branches of the main canal (through Kawaguchi) and all of the branch canals along the Uchi River; I have not uncovered a single incident involving any of these branch canals in allocation disputes. The midstream group included the thirteen branch canals from Kuranowaki to Hōdashi, while the downstream group was composed of the four tail-end canals: Harima, Naka-kyōden, Zennami, and Aoyama.

The rearrangement of the intake order of several branch canals in 1726 resulted from an allocation dispute among midstream canals, sparked by the extension of Minde and Takazaka Canals to provide water to a new development of a well-connected Tsuruoka merchant. All of the other allocation cases of the period, however, involved allegations and complaints by the downstream four against the midstream branch canals (the incidents of 1767-71, 1794, and 1824). This may simply represent skewed evidence: most of the main canal documents that survive are those preserved by the Tōzō household in Kakuda-futakuchi Village (Naka-kyōden Branch Canal). There is reason though for believing that most allocation disputes did in fact pit the downstream four against the midstream thirteen,[61] and that is the service area distribution. Most of the upstream branch canals, including those along the Uchi River, were short in length and served small areas. On the 1658 registry (Table 14), the total service area of branch canals #1-#9 and #27-#37 (along the Uchi River) was only 4,017.3 koku. This contrasts with a total service area of the midstream thirteen (#10-#22) of 15,586.887 koku and a total service area for the downstream four canals of 6,495.5735 koku. Of the total 1658 registered irrigated yield, 15% was irrigated by the upstream twenty branch canals, 60% by the midstream thirteen, and 25% by the downstream four. That most contention should have arisen between the midstream and downstream canals is not surprising.

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[61] To be more precise, Takazaka and Minda Branch Canals were rarely cited in the disputes. Neither, for example, was assigned fixed allocation standards in the 1824 investigation.

It remains puzzling, though, why the lines of conflict came to be drawn as theydwere. Why, for example, did Hōdashi Branch Canal (#21) find itself aligned with the midstream canals and against the downstream canals? Why were they not the downstream five? This we do not know, although we do know that the breaks did not correspond to administrative boundaries. Kyōden Village Group, for example, extended from Dōgata Branch Canal (#15) through Aoyama Branch Canal (#27); scatteredddamong the service areas were villages of Saigō Village Group and shogunate-administered villages. Frankly, how the midstream versus downstream line came to be drawn remains a mystery.

The conflicts of the period revolved around complaints of downstream shortages in the summer dry months and allegations that midstream branch canals had altered their division point intakes to draw in more than their 'customary' share of water. Assessment of the merits of the charges raises a number of questions. Was there a real water shortage in the downstream areas? Probably yes, although there is no evidence independent of the petitioners' claims--for example, crop reports sufficiently accurate to determine a harvest differential between various of the branch canals. Still, petitioning the domain was a noisome task, and it is probably safe to assume that given the frequency with which they undertook it, there was at least a perceived basis of complaint.

But did these shortages arise through extensive paddy land expansion in the downstream areas which forced cultivators to seek an ever larger share of main canal water? Given the lack of change in the physical delivery network, did this not begin to press at the limits of water supply and create tensions? Again, there was probably a measure of truth in this. We have seen in the second chapter that the development of new paddy lands after about 1640 tended to concentrate in the downstream areas. And its deliberate under-surveying and under-taxing meant that much of it was never fully registered.

Nevertheless, paddy land development was not limited to the downstream plain, as the example of Kimura Yachi in the 1720s illustrates. Perhaps the largest development in the Shōryūjigawa area outside of Narita, Zennami and other downstream villages was the land along the Ōyama River on the western edge of the service area. As we shall see in the next section, paddy lands developed here came to be linked to the midstream canals--Kuranowaki, Terada, Chiyasu, Hayashizaki, and others--through agreements to use excess water and drainage as morai-mizu. "Excess water" proved to be a concept open to several interpretations, and it is probable that water intake volumes increased for the midstream canals as well.

Thus, it is reasonable to suppose that water demand due to expansion of service area (in real terms) in both the midstream and downstream branch canals precipitated the shortages felt by the downstream villages. There is no quantitative evidence of increased demand, but the stress was probably limited to the summer months of drier-than-average years.

A related puzzle concerns the lag between paddy land expansion in the service area and period of allocation disputes. That is, most paddy land development in the service area took place in the seventeenth century, with little expansion after 1700; Narita-shinden Village, for example, grew in its first ten years to 630.8477 koku (1670) and reached the limits of its (registered) growth by 1700 when it topped 700 koku. On the other hand, allocation disputes do not appear until the middle to late eighteenth century. Perhaps earlier conflict records do not survive or perhaps it was the albeit smaller margin of expansion in the eighteenth century that finally exceeded main canal capacity. This, too, cannot be resolved with the present evidence.

A third question is raised by the allegations of the downstream canals that customary intake volumes and/or procedures were willfully violated by the midstream canals. Did such 'customary standards' in fact exist? Here the evidence suggests that while the 1658 registry provided a framework for deciding rights and claims to water, it was sufficiently ambiguous and future settlements sufficiently lacking in operational definitions to allow both claims for and ignorance of such "standards." The 1658 registry defined which villages of which branch canals had a full (and presumably equal) claim to main canal water (yōsui). Moreover, the inclusion of registered yields of irrigated lands, and its distinction from land registry totals by the term "irrigated land yield" (mizu takada), provided the basis for a principle of proportional allocation. Yet, there is no evidence that proportional allocation was ever explicitly recognized as a principle of water division at the main canal level. In addition, despite references to "domain fixed dimensions" of the intakes (go-jōhō), there are no surviving records of such dimensions. Of course, these might have been oral understandings transmitted through generations of officials and for some reason not committed to writing, but absence of references to such oral standards and the seemingly unregulated variation in intake design apparent in the 1753 and 1794 investigations of the domain make their existence unlikely. As we have often noted above, attention to precedent and customary procedure to maintain the status quo was a prominent component of domain administration, so appeal to tradition could be a powerful argument to a petitioner. But it remains very doubtful that prior to 1824 there were measurable and fixed standards for regulating intake volumes to which most branch canals and their water users subscribed. The 1824 standards carried the force of domain authority, but even they failed to articulate any obvious principle of water division. In sum, while there was consensus about the general concepts of normal state allocation and special state allocation (with its three forms of bansui, bunsui, and tōshimizu), when and how they were to be administered, and indeed, the general principle that water division was to reflect remained obscure enough to be a source of main canal conflict throughout the Tokugawa period.

Thus, the evidence recommends several conclusions about allocation disputes along the Shōryūjigawa Main Canal: (a) they most frequently

arose between the tail-end branch canals and the large midstream canals; (b) there were real shortages in the downstream (and possibly midstream) areas by the eighteenth century brought on by expansion of the service area in both the downstream and midstream sections (as opposed to, for example, shortages from increased per acreage water application, the problem in the present century); (c) the 1658 registry provided a documentary basis for claims to main canal water, but there was neither an articulated principle of allocation among the main canal yōsui 'water rights holders' nor accepted, concrete formulas for regulating intake volumes; (d) conflicts were a product of the summer months' water shortages and the procedural ambiguities; (e) at least one phase of these conflicts was the series of petitions and counter-petitions through the domain administrative framework, apparently reaching no higher than the rural magistrate's office; (f) while we may assume that with an unimproved physical delivery system, water shortages continued to be experienced throughout the period, the 1824 standards at last provided a means of regulating main canal water, although their enforcement in subsequent years is uncertain.

I will postpone for later consideration the important question of why there were apparently so few efforts made to improve the physical system of delivery as that question arises at each point in our inquiry. I will conclude with the observation that the middle-level administrative officials of the domain had central decision-making roles in matters of both maintenance and allocation along the main canal of the largest delivery network in the river basin (indeed, the domain), but their posture in these roles was decidedly passive and non-initiating. They were evasive of exercising authority, unwilling to take positive measures to judge claims, and fond of postponing action and the address of grievances.

Irrigation at the branch canal level

The thirty-seven branch canals in the Shōryūjigawa network were, by and large, gravity-flow earth channels serving paddy lands in one to fourteen villages, with a mean of three to six villages per branch canal. There are few surviving materials for most branch canals, but it is possible to draw out features of irrigation at this level in three areas for which documentation does exist. Their representativeness cannot be demonstrated, but the patterns of task performance do not appear atypical.

(1) Relations among branch canals: the case of Kakuda-futakuchi Village

While fifty-eight of the eighty-seven villages in the main canal service area were served by a single branch canal, water flow patterns could nonetheless implicate even these villages in irrigation matters with

villages in other branch canal service areas. Kakuda-futakuchi, a village in the downstream area (see Map 6), illustrates the complex tangle of cooperation and contention into which villages might be drawn.e Events in Kakuda-futakuchi (here referred to by its local abbreviation, 'Futakuchié) are better known than other villages because of the quantity of documents and records preserved by the Tōzō household, from which came the village headman throughout the domain period.[62] Futakuchi Village dated back to at least the late sixteenth century, but it was still a small settlement when the 1623 cadastre recorded nine households and registered lands of 129 koku. It was listed on the 1658 main canal registry at 153.8 koku, suggesting a modest paddy land expansion of perhaps 2.5 hectares.

Much of Futakuchiés paddy land was in low-lying wetland, and a continual fear was that after a heavy rain, there would be backflooding from the Ōyama River (see Map 8). At an early date, villagers joined with the neighboring village of Shin-kōya to construct an earth embankment along the Ōyama River about 946 meters long. This was maintained by the two villages, but in times of heavy damage, they could secure support laborers (tetsudai ninsoku) from other villages.[63]

The Futakuchi paddy lands were irrigated with water from the Naka-kyōden Branch Canal, whose intake was #24 along the main canal. As Table 17 shows, this branch canal had a registered service area of 1219.6554 koku (roughly 120 hectares) and served three villages, Naka-kyōden, Yunozawa, and Futakuchi. The watercourse drawn in Map 8 is only speculative. While we know that Naka-kyōden paddy land was upstream from that of Futakuchi, the location of Yunozawa paddy land is unclear. Yunozawa Village is not mentioned in the various dispute records of Futakuchi. Either its tertiary canal branched upstream of Naka-kyōden and thus was the first served or it branched below Naka-kyōden; in the latter case, it might be expected to have difficulties with Naka-kyōden similare to those of Kakuda.

Several incidents illustrate the recurrent problems faced by the smaller downstream Futakuchi in securing necessary water from the branch canal apparently dominated by the much larger and upstream Naka-kyōden

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[62] Documents of the Tōzō household are reproduced extensively in S/S 1974 and in OB 1974, my sources for this discussion. The documents are now preserved in the historical archives section of the Tsuruoka City Library.

[63] The embankment was constructed in the late seventeenth century. Futakuchi and several surrounding villages were part of the fief grant to Sakai Tadahirō in 1647, and thus became shogunate territory when he died without issue in 1668. The support laborers, when needed, were requisitioned by the Ōyama office from other shogunate territory villages.

Table 17

Naka-kyōden Branch Canal service area

village	1658 Registry (koku)	1726 Map (koku)	1877 Registry (hectares)
Naka-kyōden	866.2754	866.2754	83.02
Yunozawa	200.2	200.2	15.9287 (?)
Kakuda-futakuchi	153.18	153.18	33.9513 (?)
TOTAL	1219.6554	1219.6554	132.9 (?)

Source: S/S 1974:24-34, 43-53

Village. During a dry spell in the summer of 1805, for example, Futakuchi charged that a Naka-kyōden villager had inserted an extra 8 sun (c. 25 cm) board in the channel leading down to Futakuchi, and there were several incidents of (unspecified) violence when Futakuchi tried to remove it. Futakuchi addressed several appeals to the Ōyama shogunate officials' office; these were received favorably, but no censure was made of Naka-kyōden's violence (OB 1974:160).

A similar situation was recorded in July of 1853, when Futakuchi Village officers claimed that not even enough water for drinking was being allowed down the branch canal to them. This time, shortages were apparently widespread, as the headmen of Futakuchi Village and downstream villages in Zennami and Aoyama Branch Canals joined in an appeal to the Daihōji Village Group headman. As a result the village group headman and the rural magistrate assistant arranged a special allocation schedule (tōshi-mizu) among villages from Shinmachi Branch Canal (#14) down to Aoyama Branch Canal. That is, this was not a rotational schedule among the #14-#26 branch canals, but rather a special allocation to those villages within this area that were judged to be suffering from acute water shortage. Unfortunately, only a fragment of the schedule remains, indicating that for a two-hour period on the morning of 8.5, Futakuchi was one of four villages to receive water. The schedule seems to have been repeated later in the month, at which time the villages of Harima Branch Canal exceeded their time allocation by two hours, eliminating Futakuchi's allocation; an equivalent allotment was received later after an appeal to

the village group headman.[64]

There was also frequent trouble between Futakuchi and Naka-kyōden over the use of undeveloped wetlands or yachi. As we noted earlier, these usufruct rights to yachi lands were very important--the wetlands provided not only grasses for composting and direct fertilization but also for animal feed. There was such a yachi (known as Dekinuma Yachi) within the Naka-kyōden boundaries to which four villages had entry and use rights (Naka-kyōden, Futakuchi, Shin-kōya, and Shobu-numa).

Yachi lands were also valued as a source for mud and soil which could be used in irrigation channel bank repairs, in filling straw bags for use in bank reinforcement and diversion weirs, and in filling in land to make paddy fields. Dekinuma Yachi, though, was known as a magusa-yachi (an "animal feed grass wetlands"), and the use rights of the four villages were apparently limited to cutting and hauling out the wetland grasses. Futakuchi, however, was in the habit of using the yachi as a source of soil both for channel repairs and for constructing new paddy lands. This we may judge from the documents of a three-year dispute between Naka-kyōden and Futakuchi which began in 1811 and which was mediated in 1813 by the village headmen of Harima, Rinda, Aoyama, and Dōgata villages. This resulted in an "internal settlement" (naisai toriatsukai), a term indicating a settlement without recourse to domainnofficials. Frequently, however, the term was used in Shōnai to mean that domain officials, upon receipt of a complaint or petition, ordered that a settlement of the matter be reached through mediation of local village officers. The settlement in this case had the following conditions:

(a) that Futakuchi was to present Naka-kyōden with six 5-shō (9 liter) casks of rice wine and that henceforth it would annually present Naka-kyōden with two such casks;
(b) that upon request to Naka-kyōden Village officers, Futakuchi would be allowed to take out earth from the yachi for use in irrigation channel repairs and maintenance; and
(c) that while Futakuchi could not use yachi earth for constructing new paddy land, Naka-kyōden would overlook (minogasu) its use of yachi earth for repairs to existing paddy lands (honden fushin) and field ditch repairs in new paddy land areas.
(see document in OB 1974:174)

The document was signed by the four mediating village headmen.

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[64] The remaining fragment of the time schedule (OB 1974:164) is:

8.4 5 am to 8.5 5 am : Harima (Branch Canal?)
8.5 5 am to 8.5 7 am : Yunozawa, Futakuchi, Nonaka, & Villages
8.5 7 am to 8.5 1 pm : Zennami Branch Canal
8.5 3 pm to 8.6 5 am : Aoyama Branch Canal

As might be expected, this did not end disputes between the two villages. In 1847, for example, a meeting of Futakuchi villagers delegated a youth from the headman Tōzō's household to enter Naka-kyōden village lands and cut and take out grass. The youth was subsequently caught, fanning the animosity between the villages and requiring mediation of an unspecified area village headman (OB 1974:169-70). Then, in 1852, Naka-kyōden petitioned domain officials that Futakuchi villagers had dug out a large volume of earth from the Naka-kyōden Branch Canal channel banks and carted it away by horsed The district deputy ordered the headman of Harima Village to mediate the dispute, but no record remains of the resolution.

It was perhaps in part these problems with Naka-kyōden that had led Futakuchi villagers, beginning in 1665, to develop paddy lands on the west (left) bank of the Ōyama River, across from their settlement, in an area that came to be known as Kakuda-shinden and, alternately, Monmaed Generally speaking, lands on the west bank of the Ōyama River faced a precarious water situation. While land to the far west, against the line of coastal dunes, could be irrigated with ponded rainfall and run-off (notably the two ponds behind the town of Ōyama that remain today), lands towards the center of the plain on the west bank of the Ōyama River were in a much less favored position. They were too distant from the ponds (or rather, the ponds were too small to service them), and the Ōyama River flow was too little and too variable (or rather, its small flow was largely diverted by older villages in the very southwestern corner of the plain where the Ōyama River first entered the plain). Development of the west bank land depended in large part on Aka River water, but because this development did not really begin until after the 1658 register, these lands were not part of the main canal service area. Instead, cultivators had to negotiate with villages within the Shōryūjigawa service area to receive excess water and drainage as morai-mizu.

This was the situation with the new lands opened by Futakuchi cultivators, beginning in 1665. Indeed, rather than being able to use excess water from the Naka-kyōden Branch Canal (which drained into the Ōyama River after passing through their village, but which the evidence above suggests to have been insufficient even for their older paddy lands), they were forced to negotiate with villages from other branch canal areas. Initially, they arranged with No-kōya Village (on the Takadamugi Branch Canal) to use its excess water (josui); they constructed a flume (kakehi) over the Ōyama River to the new paddy lands (see Map 8). The supply, however, seems to have proved insufficient because in 1721 Futakuchi Village negotiated to use the drainage water (akusui) from Shōbu, another Takadamugi Branch Canal villaged They accomplished this by extending a canal from Shōbu through the land of a third village, Shin-kōya, and then constructing a second flume across the Ōyama River. They received approval and some expenses from the Ōyama shogunate officed Additionally, they promised Shōbu and Shin-kōya Villages that they would do nothing to disrupt the latter's water flow and would only expect excess

and drainage water. Presumably, there was both reimbursement to Shin-kōya for the land used in the canal extension and annual offerings of rice wine, but the documents do not state this (S/S 1974:143-5, documents 1-4).

This second water source appears to have encouraged additional expansion on the west bank in Kakuda-shinden because village records four years later, in 1725, note that 11.5 hectares of paddy lands recently opened with this water were suffering from severe drought damage! This over-expansion led to several incidents in which Futakuchi cultivators from the new west bank paddy lands were caught cutting into and stealing Shin-kōya's water (that is, the extension canal from Shōbu to the second flume ran through Shin-kōya, and Futakuchi cultivators perhaps diverted water from Shin-kōya field ditches into that channel). When caught they were ordered to send a statement of apology (and perhaps rice wine), but there is no evidence that this effectively deterred future attempts. This is a sequence of events repeated up and down the Ōyama River bank villages, as we shall see in more detailed cases below.[65]

In contrast to Futakuchi's vulnerable position vis a vis Naka-kyōden along the Naka-kyōden Branch Canal and vis a vis Shin-kōya and Shōbu Villages' canal extension, it was simultaneously involved in a protracted series of disputes of a similar nature in which it found itself in the opposite position. These disputes tended to ally Futakuchi together with Zennami and Higashi-nonuma Villages against the west bank village of Nishi-nonuma (just downriver from Kakuda-shinden; see again Map 8).

Nishi-nonuma Village had been founded at least by the 1611 cadastre and there are records of paddy land expansion within the village boundaries in 1632 and 1635; it thus substantially preceded Futakuchi cultivators' expansion across the river to Kakuda-shinden in the 1660s. Limited water resources led it to appeal in 1657 to Zennami and Higashi-nonuma Villages to use their excess and drainage water by extending Zennami Branch Canal and building a flume across the Ōyama River to its lands. The proposed flume would have to cross land lying within Futakuchi Village, so the initial petition was addressed to all three villages. In the subsequent exchange of agreements (shōmon), Nishi-nonuma promised:

(a) not to expect any irrigation water, except drainage, when there were shortages in Zennami and Higashi-nonuma;
(b) not to operate the flume in such a way as to interfere with the water flow in Futakuchi paddy lands; and

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[65] There was perhaps no further expansion in Kakuda-shinden after that; a 1772 village report (sashidashi meisai-chō) listed for the whole village 17 households (93 persons) and about 30 ha of land assessed at 301 koku. About 24 ha of that land was paddy land, including the older east bank paddy land and the newer west bank paddy land (OB 1974:50-2).

(c) to provide land in compensation for that used in canal extension and flume construction.
(S/S 1974:35-7, documents #1, #2)[66]

It was perhaps continued expansion of paddy fields that impelled Nishi-nonuma in 1722 to arrange with Futakuchi to receive the drainage water from Kakuda-shinden (ibid.: 113-4, document #1) and then in 1769, to negotiate to recieve excess water from Futakuchi paddy lands around the village (ibid.: 114, document #2).[67] In return for the latter privilege, it was to pay Futakuchi six to (108 liters) of rice annually. Additionally, apparently as part of the original agreement with the three villages, Nishi-nonuma Village annually contributed workers to the Kumaide intake and Shōryūjigawa Main Canal dredging as well as a share of main canal expense assessments.

Then, in the spring of 1796, the flume which Nishi-nonuma had constructed across the Ōyama River was washed away in the spring melt discharge, and it appealed to the domain authorities for financial assistance in repairing it. When Futakuchi, Zennami, and Higashi-nonuma Village officers learned of this, they were enraged--to judge from a statement sent by them to Nishi-nonuma which demanded:

(a) that Nishi-nonuma paddy lands were not part of the Shōryūjigawa Main Canal service area;
(b) that the Nishi-nonuma flume was in shogunate-administered landd (i.e., within Futakuchi Village boundaries) and thus to petition directly to the domain without going through the Ōyama shogunate office was highly out of order;
(c) that in the future it must never appeal to the domain authorities without notifying the three villages; and
(d) that it must realize that even if the flume is washed out, it cannot begin repairs automatically without negotiations as this might cause further damage or difficulties to the three villages.

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[66] One confuşing piece of evidence is that the surviving copy of the 1658 main canal registry includes Nishi-nonuma Village in Zennami Branch Canal (with a registered yield of 173.5016 koku). This is most certainly a mistake, as it had no full rights to main canal water. In fact, in the next main canal listing, one of the few differences with the 1658 document is that Nishi-nonuma does not appear (along with two other villages previously included in Zennami Branch Canal).

[67] Previously, drainage and excess water, if any, had been drained from Futakuchi paddy lands, at the tailend of Naka-kyōden Branch Canal, into the Ōyama River. What Nishi-nonuma received permission for was to divert this into its canal extension fromdZennami and Higashi-nonuma.

The document continues with the admonition that if Nishi-nonuma did not agree to these conditions, not only would it be denied the excess and drainage water of the three villages, but also it would be denied the privilege of using the animal-feed grassland (magusaba, similar to a yachi wetlands) of Higashi-nonuma and Zennami as a source of earth fill. Nishi-nonuma acknowledged the conditions in writing (ibid.:114-7, documents #3, #4).

The strident demands of the three villages towards Nishi-nonuma reflected a concern that Nishi-nonuma would use the repair project as a pretext for entering the official register of the main canal service area. Its prior contributions of workers and rice towards main canal maintenance and salaries represented a private arrangement with the three villages from whom it received main canal water. Now, the apparent fear of the three villages was that if the flume repairs received domain financial aid as a gōfushin project, Nishi-nonuna might then have a strong case for claiming full water rights and becoming an official part of the main canal service area. It is not without a measure of irony, of course, that at the time these three villages were vigorously insuring that the old order would be protected and that this would not happen, they were joining with other downstream villages to demand of the domain authorities an adjustment of traditional allocation of main canal water that would reduce the intake volumes of the midstream branch canals and increase volume available to their own downstream branch canals.

Antagonism between Nishi-nonuma and the three villages broadened in the following year to include use of another yachi wetland. This was the Hirono Yachi in the west bank domain village of Bara-shinden, to the northwest of Nishi-nonuma. Together with eleven other shogunate-administered villages, Futakuchi, Zennami, and Higashi-nonuma had the customary right to haul earth from the yachi by constructing a horse cart path into it; they made an annual payment of 25 bags of rice (1800 liters) (to the domain?).

The yachi seems to have been close to the borders of Hirooka and Nishi-nonuma. On a day in August of 1797, Futakuchi villagers were working in the yachi digging out earth, but because of high water in the field ditches along the path leading through the paddy fields to the yachi, they were unable to repair the path to get their loaded horse carts out. They asked cultivators in Nishi-nonuma, Hirooka, and Bara-shinden to lower the tailgates of their field ditches to let out sufficient water so that they could get the loaded horse carts out. Not only did they refuse, but in the night, they completely stopped up the water flow and allowed the whole area to flood, making it impossible for people or horses to enterethe yachi.

Nothing is known of events until the following year, 1798, when Futakuchi, Higashi-nonuma and Zennami informed Nishi-nonuma that for the present, they would not permit repairs to the flume; in 1800, the

Futakuchi Village headman attempted to abrogate the flume agreement altogether. Through intervention of the district deputy, Nishi-nonuma was at least allowed excess water during the 1800 spring transplanting period, but following this, Futakuchi repeated its attempt to abrogate the agreement, citing not only the problems with Hirono Yachi but also another matter.

It seems that there had been a major break in the embankment which Futakuchi maintained jointly with Shin-kōya along the Ōyama River, and Futakuchi argued that if Nishi-nonuma were permitted to operate the flume without repairs to the flood embankment, serious flooding of Futakuchi lands would occur.[68] It thus demanded that Nishi-nonuma supply 200 of the estimated 300 workers necessary to repair the embankment (ibid.:117-8, document #5).

Nishi-nonuma seems to have found this an unjustified demand and appealed to the domain through the village group headman, Satō Hachiemon, to intervene and temper the demands of Futakuchi (ibid.). Nishi-nonuma admitted that there was an agreement dating back about 140 years (to the time of its initial negotiations to use Futakuchi water) by which it would supply laborers for repairs to the Shin-kōya and Futakuchi embankment "here and there" (tokoro-dokoro). On that basis, it was willing to send over perhaps 20-30 persons, but it argued that Futakuchi's demand of 200 workers was entirely unreasonable. Nishi-nonuma Village officers then went on to itemize other onerous demands which the three villages had burdened it with over the years. Not only was it required to pay each village annually 7.5 bags of rice, 8 5-shō casks of rice wine and parcels of dried fish, but it was also saddled with "miscellaneous irrigation expenses"; furthermore, it was compensating the three villages with dry

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[68] In the absence of locational and technical details, I conjecture the following (see Map 8). Futakuchi complained that if the water level in the Nishi-nonuma extension canal was allowed to rise above normal levels, it would back up and flood Futakuchi paddy fields. Fearing this on occasion in the past, it had opened the spillway and drained water into the Ōyama River. With a major break in the embankment, it felt it was especially dangerous to allow the flume to operate. Flume operation involved opening and closing the gate on the Futakuchi side of the river. The gate would be closed when Nishi-nonuma did not need water, when there was no water, or when it needed water but the flow was especially low. In the last instance, the gate would be closed to allow the water level to build up, to develop a head with sufficient height and volume to flow easily across the flume when the gate was opened. This required close supervision because a delay could lead to flooding of paddy fields adjacent to the gate area and along the canal as water backed up. Futakuchi apparently wanted the spillway opened permanently to carry all drainage and excess water from Naka-kyōden and Zennami Branch Canals into the Ōyama River.

crop fields and yachi worth almost 15 koku, and it had to permit the three villages to cut the grass along its paddy field borders.

The three villages promptly sent the domain a counter-petition in which they denied all of the above except receipt of the rice, rice wine, and fish as "thanks" (orei) for allowing Nishi-nonuma to use their excess water. They protested that in a meeting between Zennami and Nishi-nonuma officers, the latter were unable to point out exactly where the so-called compensation land was. Finally, they did agree that while Futakuchi did not have cutting rights, villagers from Zennami and Higashi-nonuma did enter Nishi-nonuma lands to cut grass (S/S 1974:118-20, document #6; cf. document #7).

Resolution of this is unclear, though Nishi-nonuma continued to enjoy use of the flume. In any event, relations remained strained and in fact probably worsened over an incident several years later in 1814 concerning cutting of grass in Nishi-nonuma. Together with the grasses growing in the yachi wetlands, grasses which grew along the field borders and along the water channels and field paths were critical sources of feed for animals and, worked into the soil, valuable green fertilizer. Cutting rights were frequently conferred to another village in exchange for water use rights and were constant sources of intra-village and inter-village friction.

In late June or early July of 1814, five or six villagers from Futakuchi were cutting grass along a water channel bank in Nishi-nonuma land when thirty to forty Nishi-nonuma villagers attacked them, took away their hand sickles and straw rope, and threw them in the water channel; several were cut and injured. All of this was related in detail in a protest from Futakuchi officers (also signed by the Zennami headman) to the Ōyama shogunate office; the protest also insisted that Futakuchi had an unlimited right to cut grass along water channels, paddy field bunds, and yachi land within Nishi-nonuma.

Nishi-nonuma appears to have responded that those villagers were from Futakuchi's west bank settlement (Kakuda-shinden, formerly a part of Futakuchi) and thus had no such right. Futakuchi then claimed that the construction of a channel from Kakuda-shinden to Nishi-nonuma in the early 1700s indeed gave them the right (S/S 1974:122-3, document #8). It asked for compensation for the injuries suffered and a statement from Nishi-nonuma formally specifying this cutting right. Nishi-nonuma did send a statement addressed to Futakuchi and Zennami acknowledging the latter's right to cut grass around the flume area and along the extension canal banks though details of the mediation required to secure such agreement are lacking (ibid.:123, document #9)e

A document sent the following year (1815) to the shogunate office by Futakuchi claimed that Nishi-nonuma was not living up to the agreement; Nishi-nonuma apparently declared that it did not need the water it had

been getting from Kakuda-shinden and closed off the gate, creating much flooding on Kakuda-shinden lands. Futakuchi reported in a follow-up petition in April that it had dug a 130 ken (237 meter) drainage channel to the Ōyama River for its drainage water (actually, it probably redug and old channel used before the agreement with Nishi-nonuma) (S/S 1974:124-5, documents #10, #11).

Nishi-nonuma responded with a request to domain authorities that it wanted to build a flume from Futakuchi to use the three villages' water at the place where Kakuda-shinden drainage channel emptied into the Ōyama River but that this would require construction of an embankment (presumably along the west bank of the Ōyama River); because the labor requirements would be high, it asked that it be designated a domain public works project (gofushin). Nishi-nonuma further proposed to Futakuchi that instead of the overhead flume (kakehi) it construct a river diversion weir and intake (irihi).

This proposal is difficult to evaluate in the absence of technical details, but it appears to have been a shrewd one. Nishi-nonuma was clearly still trying to get onto the official service area registry--or at minimum to secure some form of domain protection for its water sources, in the belief that domain support for its water works would bring domain sanction for its water supply. In addition, it was attempting to redesign its delivery system in such a way that it could use Kakuda-shinden drainage water without obligation. That is, previously, it had two water sources; it extended a channel from Kakuda-shinden to its paddy lands and it had dug a channel from Zennami and Higashi-nonuma through Futakuchi and then over the Ōyama River by overhead flume to its paddy lands. When it told Futakuchi that it no longer needed the Kakuda-shinden drainage, Futakuchi responded by reopening a direct channel from Kakuda-shinden to the Ōyama River. Now Nishi-nonuma was proposing that instead of an overhead flume for the second source, the three villages' water be drained into the Ōyama River (through the embankment) and that Nishi-nonuma then construct a weir in the river just downstream of the discharge to divert the water into a cut (irihi, also referred to as sokohi or umehi) through an embankment it would build (by reinforcing the existing levee) on the west bank of the Ōyama River. Because this weir-irihi would also be downstream of the Kakuda-shinden drainage outlet, it could divert that water as well (without the former obligations such as cutting rights and annual payments of rice and wine).

Needless to say, Futakuchi was opposed to such a shift from flume to weir, claiming that this would interfere with Kakuda-shinden drainage and that past documents clearly referred to an "overhead flume" (uehi or kakehi); it threatened that it would withdraw its permission to run the extension channel from Zennami and Higashi-nonuma through its lands if the design change was made. The response of Nishi-nonuma, as reported in a Futakuchi petition to the Ōyama shogunate office, was that there was in fact no record which specified "overhead flume" and that they intended to

go ahead with the proposed change. Futakuchi appealed to the Ōyama office that it have the domain order that all embankment work be done by Nishi-nonuma and that, as in the past, an overhead flume be installed.

Two days after this appeal, on May 1st, village officers from Futakuchi were summoned to the Ōyama office. They were informed that Nishi-nonuma had petitioned the domain (i.e., village group headman) that the diversion of Kakuda-shinden drainage into the Ōyama River wasecausingethem considerable difficulties (this was the time of spring field preparation and transplanting); because of that they had requested that the old extension channel from Kakuda-shinden to Nishi-nonuma be re-opened temporarily. The same day, after the Futakuchi officers had returned home, they were visited by village officers from Nishi-nonuma, Bara-shinden, and Hirooka, who informed them that the domain had agreed to provide financial support for the proposed irihi project. They further annoyed the Futakuchi officers by not mentioning the subsequent petition to the domain to order a temporary re-opening of the Kakuda-shinden extension channel (Futakuchi reports this in a somewhat injured tone in document #12, ibid.:125-6, implying that at least they might have had the courtesy to request it directly of Futakuchi!).

Despite the affront, the extension channel was apparently reopened, because other Futakuchi documents (#13-4, ibid.:126-7) from later in May detailed continuous squabbling between Futakuchi and Nishi-nonuma over the opening and closing of the gate along that channel leading from Kakuda-shinden lands into Nishi-nonuma lands.

The year did see some resolution to the wrangling, however. At the beginning of June, acting on orders from the district deputy, Nishi-nonuma finally returned to Futakuchi four hand scythes and two lengths of straw rope that villagers had taken from Futakuchi villagers in the previous summer's attack. Then, in September, through the mediation of headmen from Umamachi and Ara-kōya Villages (acting as toriatsukainin), some measure of settlement was reached. In the exchanged agreement papers (sumi-kuchi shōmon, document #15, ibid.:127), Nishi-nonuma formally requested use of Kakuda-shinden's excess and drainage water. The direct drainage channel to the Ōyama River was not to be opened up, and procedures were specified for operating the gate along the Kakuda-shinden/Nishi-nonuma channel. When the closed gate threatened to back up the water and flood Kakuda-shinden paddy lands, it was to be opened by Nishi-nonuma; after 70-80% of the water had drained through, Futakuchi would notify Nishi-nonuma and the latter would close it again.

As an addendum to the agreement, the Ōyama office also ordered Nishi-nonuma to pay Futakuchi two bags of rice for its efforts in reopening the drainage channel to the Ōyama River from Kakuda-shinden (which then was not used). Futakuchi was also to receive one bag of rice in payment for injuries to one of its villagers in the previous summer's attack; half of the bag went to the victim, half of the bag financed two

casks of rice wine for all the villagers. There was no mention of the issue of the overhead flume.

(2) A midstream branch canal: Hayashizaki Branch Canal

Hayashizaki Branch Canal, one of the large midstream branch canals in the Kyōden area, provides another example of a branch canal which came under pressure to grant morai-mizu water rights to new developing paddy lands across the Ōyama River. It contrasts with the Nishi-nonuma case in that domain officials, appearing more indecisive here, were unable to persuade villages in the Hayashizaki Branch Canal service area to grant these rights.

Hayashizaki Branch Canal in 1726 had a registered paddy land service area of 1890.8260 koku spread among seven administrative villages (see Table 18). Four of these villages had paddy lands wholly contained in this branch canal service area, while three others had lands in one other branch canal area. Hayashizaki Branch Canal took off from the main canal just west of the castle town and ran roughly northwest through the Kyōden area, draining into the Ōyama River (see Map 6). There are references in the documents to a branch canal guard (seki-mori); the role was apparently customarily filled by a villager from Hayashizaki Village (Jinushi 1958:35). Together with guards of three other branch canals in the Kyōden area, he is said by a present-day historian (ibid.) to have 'served under' the Kyōden Village Group headman, but the exact meaning of that claim is not clear.

In the late 1660s, Yonede, a west bank village, developed a new area of paddy named Rokumyō-shinden and constructed an overhead flume across the Ōyama River to use drainage water from Yurushi-tori and No-kōya Villages, along the Takadamugi Branch Canal (whose service area was adjacent to that of Hayashizaki's). In 1714, the flume measured 4.84 meters long, 0.76 meters wide and 0.42 meters high. As expansion proceeded in Rokumyō-shinden, that water supply seems to have proved insufficient because in 1766, Yonede applied to the domain for permission to construct a second flume across the Ōyama River which would connect with Hayashizaki Branch Canal and use its excess water (sute-mizu).

This drew a strong protest in the form of a document addressed to the village group headman and the rural magistrate and signed by the two Kyōden main canal guards[69] and the headmen of forty villages in the mid- and downstream sections of the Shōryūjigawa network; these included headmen of Shōbu-numa, Shin-kōya, and Futakuchi Villages, all of whom we

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[69] This is the only document I have discovered in which the Kyōden Main Canal Guards appear as signatories.

Table 18

Hayashizaki Branch Canal service area

village	1658 Registry (koku)	1726 Map (koku)
Hayashizaki	991.8860	999.8860
Nishi-kyōden	400.1020	400.1020
Takadamugi	58.	58.
Abe-kōya	38.556	38.556
Daibe-kyōden	282.282	282.282
Tanba-kōya	70.	120.
Niigata	106.1751	0.
TOTAL SERVICE AREA	1946.1001	1890.8260

Noted As discussed in the text, the differences in the 1658 and 1726 figures may merely reflect errors in the surviving copy of the documents, as might the 8 koku discrepancy between the 1726 service area total and the sum of the village totals.

Source: S/S 1974:24-34, 43-53

have seen were at the time involved in similar arrangements with west bank villages. Although Yonede Village was in shogunate-administered territory, six of the forty signers were also shoguate-administered villages (including Shōbu-numa, Shin-kōya, and Futakuchi), supporting evidence previously cited that this domain-shogunate administrative distinction was of little consequence as a predictor of alignments in irrigation matters.

In this protest (document #1, S/S 1974:130-2) of April of 1767, they claimed that while in the past there might have been some surplus water in the Hayashizaki Branch Canal, because of recent water shortages in the main canal area, domain officials had surveyed and ordered a narrowing of

the branch canal's intake gate dimensions.[70] They reminded the domain that previous requests by west bank villages, such as the one in 1735, had been turned down. Finally, they claimed that the headman of Rinda Village (along the Takadamugi Branch Canal) had been acting improperly in supplying water to Yonede through the existing flume; they charged that although he said the water which Rinda, Yurushi-tori, and No-koya Villages were supplying was drainage water (akusui), it was in fact "irrigation water" (yōsui), i.e., extra water taken in from the main canal along Takadamugi Branch Canal expressly for Yonede. The protest asked that this arrangement be halted.

Domain officials apparently made an attempt to persuade the Kyōden villages in a communication in October of the same year, but the Kyōden villages responded adamantly in a petition of the same month (document #2, ibid.:132-3). They noted that because of frequent dry periods in the summer months, the eleven branch canals of the midstream and downstream sections of the network cooperated(!) in sharing water; thus, the matter of Yonede's request was not merely of Hayashizaki's concern. They insisted that there was no excess water (sute-mizu) in the summer months as even adequate drinking water supply was imperiled. They closed with the reminder that changes in the intake gate dimensions of Hayashizaki Branch Canal had further eliminated any possibility of excess water.

Efforts of domain and Ōyama shogunate officials to persuade the Kyōden area villages continued through the year; they argued that Yonede would simply be using water which the branch canal dumped into the Ōyama River and that it would not be receiving "irrigation water" (yōsui). Yonede would further neither expect water when there were shortages nor cause any disruptions to branch canal water flow with the operation of its flume. Again the Kyōden villages refused. The matter was never seen by them as only affecting Hayashizaki Branch Canal, and they were clearly wary of being open to escalating demands from Yonede, once the gate was open, so to speak.

The issue continued for several years, and in May of 1772, the Kyōden area villages again refused domain overtures. This time, they specifically cited the case of the four west bank villages of Ōyama, Tomoe, Sunaoshi, and Yanagihara-shinden which had been receiving excess water from branch canals in Yodogawa Village Group (Terada and Kuranowaki Branch Canals). These four villages were now demanding regular allocation shares (bunsui) and wanted to be included on the main canal registry. Such claims, they noted, were now seriously complicating efforts by villages in the downstream section of the main canal service area to secure a readjustment of main canal allocation water (document #4, ibid.:134-5, cf. document #5, ibid.:135-6).

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[70] This refers to the 1753 survey of branch canal intakes by domain authorities and subsequent changes ordered in intake dimensions.

Unfortunately, final disposition of the issue is not known, although there is no evidence to suggest that Yonede was successful in its request. After the above discussion of Futakuchi and Nishi-nonuma, the pattern is familiar however. The humbly stated guarantees of non-interference which accompanied the request are predictable, but we may also pardon the skepticism of the Kyōden area villages, given the difficulties of Futakuchi, Zennami, and Higashi-nonuma. Although we cannot judge the degree to which there actually was a volume of usable excess and/or drainage water available at the tail-end of the branch canal, the fears of the branch canal villages seem justifiable enough--not only in the light of the tendency for water once received to become customarily expected but also because of the vociferous complaints of downstream branch canals and the subsequent adjustment of midstream branch canal intakes in 1753 and later in 1794.

The last point also explains the support lent to the Kyōden area petitions by downstream villages such as Futakuchi, Zennami, and Narita-shinden. Such an arrangement could come to have unpleasant consequences for their available water supply as well. But it is, of course, further evidence of the situational nature of cooperation and contention in the network that they would be joining together with and in support of midstream villages at the same time as they were engaged in rancorous disagreement with them.

The somewhat irresolute conduct of domain officials (i.e., the village group headman and rural magistrates) in the matter is also interesting. This may very well reflect the fact that the officials were caught in the middle in this issue. Yonede Village was in shogunate-administered territory which meant that paddy land expansion there would be of no profit to the domain; at the same time, because the matter did involve the shogun's lands, it perhaps felt impelled to lend some assistance to the request. It thus ended up straddling the fence: attempting to persuade but not ordering Hayashizaki Branch Canal villages to grant Yonede water use rights. The case illustrates another irrigation context in which the decisive exercise of domain authority was constrained by circumstances.

(3) A downstream branch canal: Aoyama Branch Canal

The third example of matters at the branch and tertiary canal levels and the manner in which they were handled concerns Aoyama Branch Canal, at the tail-end of the main canal. More particularly, it concerns problems along the tertiary level canal serving Narita-shinden.

In the 1650s, Aoyama Branch Canal served the four villages of Aoyama, Tenshindō, Obana, and Inoko (see Maps 4 and 6). The canal branched from the main canal just west of Yunozawa Village and passed first through Aoyama and then Tenshindō, both built on high ground along the levee of

the Aka River. At Tenshindō, a tertiary canal seems to have branched west to the paddy lands of Obana Village. The branch canal continued through Tenshindō to Inoko Village, where it turned west to serve the Inoko paddy lands in the low-lying center between the Aka River and the Ōyama River. I conjecture that drainage water was conducted through several channels, including the tail of the branch canal itself, into the Ōyama River.

Then in 1658, Narita-shinden was founded in that extreme downstreamd triangle of land bordered by the Aka River, the Ōyama River, and Inoko Village lands. As discussed in chapter two, the founders and backers of the new village, including the Kyōden Village Group headman, Narita Heizaemon, successfully concluded negotiations with the four villages to dig a channel from the Aoyama Branch Canal to Narita lands. The original document does not survive, but later records show that in compensation for land used in the channel construction, Narita-shinden granted developed land within its boundaries to three of the four villages. Aoyama recieved 1.73 hectares of paddy land, Tenshindō, 1.69 hectares, and Inoko, 4.42 hectares of yachi grassland. Compared with Narita-shinden's initial total development of 300 koku, the land granted was not inconsiderable. However, because an early attempt to take in water directly from the Aka River had failed, Narita-shinden had no other choice (Ōse 1952).

As Map 4 indicates, a 4423 meter channel was dug from Aoyama Branch Canal on the edge of Aoyama Village, through the territory of Aoyama, Tenshindō, and Inoko Villages. As it entered the Narita-shinden settlement, it divided into an "Upper Canal" of 1128 meters in length and a "Lower Canal" of 1747 meters. Field ditches ran off of these two canals (an exception to the general pattern of four levels of water delivery canals); Ōse (1952:18) estimates that field ditches totalled another 7280 meters and drainage ditches (yoko-sado), 1820 meters. Water was drained into the Ōyama River just above its confluence with the Aka River through gates in the embankment.[71] The gates also served to prevent backflow from the river during high water from going up the channels and flooding the fields. There were four such gates, approximately 12.7 meters long, 3.4 meters high, and 3.6 meters wide. They were said to require replacement every eight years. A Project Completion Report (deki-mokuroku) for one such replacement project in 1746 suggests that the gates were major, costly works; one gate that year cost 24 ryō in total project expenses (equivalent at the time to about 24 koku of rice; see the document in Ōse 1952:18-23). Because it was a domain public works project (gofushin), the domain paid for half of the expenses.

The fact that the Narita Tertiary Canal ran through three villages from its intake above Aoyama Village was the source of constant difficulties for Narita cultivators. The following two series of incidents illustrate

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[71] This was the embankment constructed in the 1660s that was the locus of considerable friction with Obana Village, as we saw above.

theseedifficulties; while both occurred in 1812, they are no doubt typical of long-standing problemse (Both cases are based on documents reproduced in Ōse 1952:67-74.)

One of these problems was with the village of Inoko, which had argued in the past that Narita did not have full rights to Shōryūjigawa main canal water. The implication was that Narita would have to ask Inoko for water (morai-mizu), to which conditions of dependence could be attached. In late May of 1812, just before transplanting, it reiterated that claim and stopped the flow to the Narita Tertiary Canal.

The question of Narita-shinden's rights to Shōryūjigawa water was somewhat problematical. The village was founded in 1658, the same year as the main canal registry was drawn up, and while it does not appear on the surviving copy of the registry list, it is written in on the accompanying map. Moreover, in one of the few changes in the 1732 listing, it appears as "Aoyama Branch Canal" (Aoyama edaseki), the only such tertiary level canal to be recorded. It was distinct from the "Aoyama Canal" listing, which itemized the registered irrigation acreage yields for the four original villages. "Aoyama Branch Canal" then appeared as:

Aoyama edaseki taka 339.728 koku
Inoko-mura
Narita-mura

Because Inoko is itemized under the main canal column, I suspect that the 339.728 koku is actually the Narita-shinden figure alone. This listing, though somewhat irregular, and the fact that some of its watereworks (e.g., the drainage gates) were domain public works projects, strongly suggests that it had a clear and full claim to main canal watere

Narita-shinden so argued this in a petition to the village group headman in late May or early June, noting further that it was alloted a labor requisition share in Kumaide intake reconstruction and repair and that it paid a full share in the upkeep of Aoyama Branch Canal. The villagers were thus in every way "children of the canal" (seki-ko).

Despite several such petitions to the village group headman that he order Inoko to let their water through, he apparently did not act. Narita-shinden asked for a meeting with Inoko Village officers. As they were approaching the village, a horn blew and they found themselves surrounded by a large crowd of Inoko Villagers; a fight seemed imminent. In subsequent exchanges, Inoko officers insisted that although the channel itself might belong to Narita-shinden, the water was Inokoes, and it refused to allow any of it to pass down to Narita lands.

Narita then sent a direct petition to the rural magistrate, realizing that the village group headman was not going to act (document in Ōse 1952:70-2). As a result, an assistant in the rural magistrate's office

conducted a survey of the Narita Tertiary Canal and discovered four places along the channel where Inoko cultivators were taking out water. The rural magistrate ordered these filled in, ordered Inoko Village to allow water through to Narita, and imposed a modest but unspecified punishment on the Inoko Village headman and water guard (documents in Ōse 1952:73-4).

A second incident involved difficulties with Tenshindō Village. Water flow in the Narita Tertiary Canal again stopped on Junee10, just at the height of rice transplanting and just after the above problems with Inoko. Upon investigation, Narita cultivators discovered that a number of cuts had been made in the Narita channel within Tenshindō lands, through which most of the water was being drawn out. Tenshindō refused to repair the cuts, so Narita cultivators did. Shortly thereafter, the banks were cut into again at night, and again Narita cultivators made the necessary repairs. When this continued, it was forced to post guards day and night along the channel, a costly exercise during transplanting, one of the two peak labor demands of the year. Narita finally appealed to the village group headman, who this time agreed with Narita's grievance. He ordered that the disruption of flow cease, although no penalties seem to have been assessed Tenshindō (document reproduced in Ōse 1952:67-8).

Chapter VI

THE NAKAGAWA NETWORK

The second water delivery network that will be examined is the Nakagawa canal network. In paddy land served, Nakagawa was in the Tokugawa period and remains today the second largest in the Aka River basin. In the 1850s, its registered paddy land yield totalled approximately 17,300 koku, compared with Shōryūjigawa's registered yield of 31,800 koku. Together they represented about one-quarter of all registered paddy land in Shōnai Domain. In contrast to Shōryūjigawa's upstream intake position along the Aka River, however, the Nakagawa intake was downstream of all others except the very small Daihōji Main Canal, which served about thirty hectares of paddy land east of the castle town. In this chapter, we will have occasion to note a number of similarities and contrasts between irrigation matters in the two networks.

It is worth reiterating at the outset that in the Nakagawa area, as in the rest of the basin, 'hydrological' lines of water courses only poorly matched domain administrative boundaries. Fifty-two of the fifty-three administrative villages in the main canal service area were organized into four domain village groups; in addition, some of the lands of two of these villages and of the fifty-third village were part of a fief grant from the domain lord to Katō Tadahirō in 1632. When Katō died in 1653, these lands reverted to shogunate administration (as we saw with some lands within the Shōryūjigawa area).

One of the four village groups, Kurogawa, was attached to Kushibiki District, while the other three were attached to Nakagawa Districtn Only two of the four village groups were wholly contained within the service area, and only one of these-- the small Oshikiri Village Group-- corresponded to branch canal water course lines; it comprised the seven villages of Oshikiri Branch Canal.

These were the administrative divisions of the latter half of the domain period (see Table 19 and Table 20). There had been some administrative elaboration and shifting through the period, but it does not appear to have been related to water course divisions. At the end of the seventeenth century, Yokoyama Village Group was divided into possibly three village groups--Naganuma, Aragawa, and Yokoyama Village Groups. Then, at some time between 1718 and 1720, there was a further

rearrangement that shifted five administrative villages back to Yokoyama Village Group from Aragawa and created Oshikiri Village Group from seven other villages in Yokoyama Village Group. Only the last shift can be said to reflect water course divisions, though there is no evidence that irrigation matters prompted the realignment.

Generally speaking, most of the villages in the upper two-thirds of the Nakagawa service area existed with at least some surrounding paddy lands in 1615, the estimated date for the digging of the main canal. That is, there is evidence for agricultural settlements in the area along the Aka River bank (the western edge of the service area) as far down as Yokoyama,[72] along the Kurose-Fujishima River (the eastern boundary of the service area) as far as Hirakata and Yokogawa Villages, and some expansion in the center of the service area down as far as Katō Village (see Map 9). Soon after the main canal was dug, there was expansion of paddy land along the Aka River beyond Yokoyama with the settlement of Sanbongi, Tsushima, and Oshikiri Villages (YKS 1980:546). In the second half of the seventeenth century, new villages appeared in the downstream area; residential settlements concentrated on the higher ground along the Aka and Fujishima Rivers with paddy lands opened to the center through draining and conversion of the low-lying, wet grassland; Yokogawa-shinden and Doguchi to the east and Fukuoka to the west were settled at this time. The biggest single development was the registry of almost 49 hectares of new paddy land in Shimo-doguchi in 1685. Finally, in the eighteenth century, the most downstream areas began to be opened up, notably Hirono-shinden beginning in 1713 and Okui-shinden in 1788.

At the same time, of course, there was paddy land development in the upstream areas as well, exploiting remaining grasslands, draining small swamps and bogs, and converting dry fields. Table 21, however, suggests from scattered and scanty evidence that after at least the mid-1600s, and with several local exceptions, there was only modest (registered) expansion in the upper two-thirds of the service area. I estimate that in 1675, the total registered yield of paddy lands within the Nakagawa Main Canal service area was in the range of 12,000 koku, that in 1775, this total was in the range of perhaps 16,000 koku. By the end of the domain period in 1867, the total was 17255.1712 koku.

It is of course quite difficult to obtain accurate figures for the extent to which registered yields and acreages under-represented actual acreages. However, the national land survey, undertaken in 1874-6 as part of the reformation of the land tax and conducted rather fastidiously in areas like Shōnai which had opposed the new central authorities, does permit some estimates of under-registration in the domain period. Paddy land acreage figures for the 1867 village registers and for the post-Land

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[72] With the exception of Ishino-shinden, a small area at the very top of the service area not developed until the late 1700s.

Table 5.1 Administrative divisions within the Nakagawa Main Canal service area

District	Village group	Totala# of villages in village group	# of villages in main canal service area	Registered yield of villages within service area (1860)
Kushibiki	Kurogawa VG	49	7	731.0000 koku
Nakagawa	Aragawa VG	17	10	3026.2377
Nakagawa	Yokoyama VG	28	28	10900.8721
Nakagawa	Oshikiri VG	7	7	1896.3612
shogunate-administered		74	1 (+2)*	700.9002
Total registered yield of the main canal service area (1860)		==		17255.1712 koku

*Shogunate-administered lands in the main canal service area consisted of one administrative village, Wanagawa (400.d922 koku), and parts of two adjacent villages, Higashi-watamae (220.0000 koku) and Makunouchi (80.7080 koku). As noted in chapter four, this was part of a fief grant made in 1633 that reverted to the shogunate in 1653.

Sources: Calculated from several sources that differ in some details: Shimoda 1927:51-52; OB 1974:154; Nakagawa Irrig Coop 1935.

Table 20

Administrative villages in the Nakagawa Main Canal service area

village	households (1850)	principal land tax rate (1850)	village registered paddy land yield (1867)
Matsuo	?	?	200* koku
Kawahara	?	?	90*
Akagawa	?	?	250*
Ishino-shinden	?	?	26*
Shimo-mawatari	?	?	21*
Nakajima	?	?	74*
Osaeguchi	14	28%	85.0417
Hosoya	29	45%	660.8531
Makunouchi	18	43%	400.1922
Mitsubashi	15	41.3%	97.3756
Kariyanome	47	41.3%	728.9895
Kami-aramata	24	42%	371.9512
Naka-aramata	25	42%	323.6168
Shimo-aramata	24	42%	252.1433
Aramata-shinden	0	33%	31.3939
Mimasu-shinden	18	39%	74.6804
Higashi-watamae	19	32.2%	381.9835
Higashi-watamae (shogunate)	32	?	220.0000
Nishi-watamae	41	33%	706.7379
Makunouchi (shogunate)	8	?	80.7080
Makunouchi-shinden	0	61%	24.4932
Daihanda	?	49%	608.9679
Tsukegawa	35	52%	539.9185
Arayashiki	42	51.2%	417.4744
Matagari-shinden	3	46%	29.4854
Kami-fujishima	28	38%	412.6338
Hirakata	67	54%	365.7506
Wanagawa (shogunate)	30	?	400.1922
Sunazuka	11	55%	247.7019
Yokogawa	83	47.9%	751.1241
Yokogawa-shinden	28	44%	124.4421
Tsutsumino	19	65%	152.4193
Yokouchi	36	51%	476.6840
Tsuchibashi	33	43%	485.5421
Takewarada	13	54%	427.0869
Shōshaku	20	52%	308.4243
Hishi-nonuma	15	43%	250.3158
Katō	11	?	162.2503
Kami-doguchi	15	49%	46.5240
Shimo-doguchi	41	29%	611.4475

Yokoyama-kamigumi	38	57.2%	894.8469
Yokoyama-nakagumi	78	57.2%	772.4911
Yokoyama-shimogumi	54	57.2%	694.9317
Sanbongi	37	47.3%	184.4304
Tsushima	?	47.3%	397.8342
Oshikiri-kamigumi	73	47.3%	184.4304
Oshikiri-nakagumi	68	47.3%	272.7250
Oshikiri-shimogumi	63	47.3%	257.6874
Fukuoka	?	?	321.6275
Koya	4	33%	52.8418
Ofuchi	?	?	114.1909
Hirono-shinden	138	30%	914.5916
Hayashi-shinden	0	36.9%	18.6920
Okui-shinden	15	33	80.6580
Nakamura	?	?	?

*n=nThese are only approximate yield totals for these villagesn

Sources: compiled from OB:110, Naganuma 1964:437-442, and Nakagawa Irrig Coop 1935

Table 21

Paddy land expansion in Nakagawa service area villages

A. This table compares figures for total village registered yields from a Shōhō era (1644-48) map, a portion of which is reproduced in Nakagawa Irrig Coop 1935, with similar figures from the 1867 village land registers (omizuchō). Because the figures are those of total registered yields and not just of paddy land yields, they are useful only in suggesting the magnitude of expansion. "Yokoyama" on the Shoho map included the three Yokoyama villages and the village of Tsuchibashi.

village	Shōhō era (1644-48)	1867
Osaeguchi	130.202 koku	125.8217 koku
Hosoya	722.1	719.6047
Tsukegawa	620.8	641.6396
Arayashiki	424.169	434.8377
Kami-fujishima	481.302	501.5532
Tsutsumino	40.69	174.1200
Yokouchi	471.135	504.2975
Nishi-watamae	782.489	851.7636
Shōshaku	312.999	331.6983
Hishinonuma	233.194	254.7245
Yokoyama	3161.731	3204.4798
Sunazuka	60.344	261.4329
Katō	167.755	167.9511

B. A second set of figures are here collated to compare registered acreage of paddy land on the 1669 omizuchō with that on the 1867 omizuchō.

village	1669	1867
Tsushima	38.7 hectares	42.8 hectares
Sanbongi	17.3	19.3
Oshikiri-kamigumi	33.8	37.6
Oshikiri-shimogumi	28.0	37.7
Kami-doguchi	1.8	6.9
Shimo-doguchi	2.5	70.2

Source: OB 1974:102-3

Tax survey 1876 registers are known for twenty of the fifty-three villages in the Nakagawa network (see Table 22). It is safe to assume that there was little, if any, paddy land conversion in that nine-year interval and that the increases in paddy land acreage reported after the survey reflect the under-registration in the domain village land registers. It is significant to note that while in all cases there was a discrepancy in paddy land acreage, there was wide variation in the order of such discrepancies (from 1.29 times in Naka-aramata to 3.53 times in Hirakata) but there was no simple correlation between extent of under-registration and location in the service area. Figures are not available for villages in the most upstream and the most downstream areas, but it is interesting that the five Oshikiri area villages, located along Oshikiri Branch Canal at the tail-end of the main canal, were surveyed at only 1.41 times their domain period acreage. The three Aramata villages, settled either before or immediately after canal construction in the 1610s and located in thee upstream section, were surveyed at 1.81 times (Kami-aramata), 1.29 times (Naka-aramata) and 1.60 times (Shimo-aramata) their domain register figures, a variation difficult to explain.

The evidence, then, suggests that in the Nakagawa network, as in the Shōryūjigawa networkę the taxable, registered paddy land acreage figures considerably understated actual paddy land acreages by the end of the domain period. If one assumes that the range of variation in under-registration in the twenty villages for which figures are known holds true for the entire main canal service area, and given a known post-Land Tax main canal acreage figure of 2971.07 hectares, the registered acreage of the main canal service area in 1867 would have been 1632.46 hectares (a 1.82 increase after the 1875 survey). I will argue in this chapter that this under-registration of acreage--its extent and variation among villages--was probably at once an important factor in water allocation disputes and at the same time a reason why such disputes were not pressed in too much detail with domain authorities.

The intake and main canal

Chapter one reviewed the few details known of the origins of the Nakagawa Main Canal. Circumstantial evidence suggests canal digging was organized by a district deputy of Niizeki, himself the deputy placed by Mogami at the rebuilt fortifications at Tsuruoka, in cooperation with local peasant cultivator leaders in about 1615. Throughout the domain period there is no mention of construction of a gate at the intake cut through the river levees (known as ichi-no-kuchi, the "first opening"), and I believe it reasonable to assume that the intake remained a temporary structure--a simple cut in the levee, with minor reinforcements of the earth sides to retard erosion. Indeed, the location of the intake itself was apparently subject to some change (Nakagawa Irrig Coop 1935); because it was near the bottom of the alluvial fan section of the river, it was

Table 22

Comparative paddy land acreages in selected Nakagawa villages

village	1867 land register	1876 land register	change (1867=100)
Kami-aramata	30.14 hectares	54.47 hectares	181
Aramata-shinden	c. 2.70		
Naka-aramata	35.33	45.46	129
Shimo-aramata	19.94	31.84	160
Daihanda	46.53	63.64	137
Higashi-watamae	24.66		
Higashi-watamae (shogunate)	c. 16.00	177.00	187
Nishi-watamae	54.07		
Arayashiki	35.10		
Matagari-shinden	c. 2.45	87.71	234
Hirakata	32.48	114.71	353
Kami-fujishima	31.51	56.39	179
Kami-doguchi	6.89		
Shimo-doguchi	70.20	188.28	244
Sunazuka	19.01	29.50	155
Tsushima	42.75		
Sanbongi	19.30		
Oshikiri-kamigumi	37.64	244.41	141
Oshikiri-nakagumi	36.44		
Oshikiri-shimogumi	36.74		
TOTAL	599.88	1093.39	182

Sources: Based on land registry figures in village entries in OB 1974 and Naganuma 1965.

probably necessary to shift the intake location with small changes in the river course that might occur after heavy discharges. As with most of the other main canal intakes, a line of triangular log frames was positioned across the river to raise the water level and guide river water to the intake in the summer months.

The main canal in the seventeenth century was referred to as Nakagawa ōseki Tenkō seki ("Nakagawa Main Canal/Tenkō Canal") suggestingda bifurcated main canal; that is, a document from that century refers to the Nakagawa ōseki, about 9 km long from the river intake down to the "Kiyomizu Willow Tree" at Sunazuka Village, and Tenkō seki, which branched from Nakagawa ōseki about 2.2 km downstream of the river intake and itself ran about 2.6 km to the village of Mitsubashi (see Map 9). Together they constituted the main artery, the first level of water delivery in much the same way that the Shōryūjigawa Main Canal and the Uchi River composed the first level of water delivery in the Shōryūjigawa network.

Little else is known of the earliest form of the Nakagawa network, although working back from later elaborations, I would suggest that there may have been four branch canals off the Tenkō Main Canal and eight branch canals from the Nakagawa Main Canal. That is, somewhere along Tenkō Main Canal was a branch delivering water to Matsuo, Higashi-kawara, and Nishi-kawara Villages; at its termination, three branches led to Mitsubashi, Karinome, and the Aramata Villages. Along the Nakagawa Main Canal were intakes to branch canals to Akagawa Village (#3 on Table 23); to Hosoya, Osaeguchi, and Makunouchi Villages (#4); to Daihanda Village (#5); to Watamae and Hirakata area villages (#6); to Yokogawa Village (#7); to Tsukegawa Village (#8); to Wanagawa Village (#9); and from the tail-end of the main canal at Sunazuka Village, a large branch canal delivering water to Yokoyama area villages and the Katō and Shōshaku area villages.

I would further conjecture that there was downstream elaboration in the 1620s; with the development of the Oshikiri villages, the main canal was extended as far as Kamenoyama just upstream of Yokogawa-kamigumi. Tsuchibashi Village, previously served by a tertiary canal from the Yokogawa Branch Canal (#7), was now served by its own branch canal (#11), and a new branch canal was dug from Kamenoyama to service the new Oshikiri, Sanbongi, and Tsushima Villages (#12). Final extension of the downstream section took place in the 1700s, with the digging of the Hirono-shinden Branch Canal (#13) in 1718 (unpublished source #3). The only other branch canal to be added later was the small Ishino-shinden Branch Canal, opened in the last half of the 1700s at the very top of the service area to irrigate a limited (26 koku) area next to the Aka River.

Water flowed along the main canal and branch canal levels by gravity, and there seems to have been no use of water-lifting devices at these levels. There was, however, one difficult stretch in the upstream section (known as hako-no-uchi, literally "within-the-box"), caused by a

Table 23

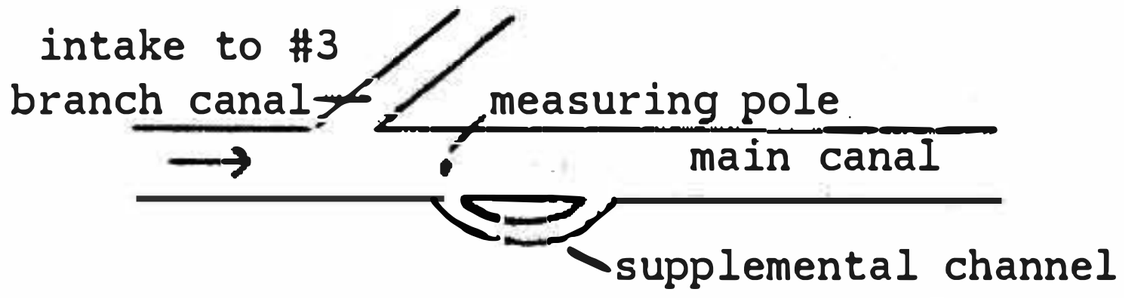
Branch canals along the Nakagawa/Tenkō Main Canal

branch canal(1)	number of villages served	1785 intake structure: fixed and lined main canal	measuring pole	intake entrance	spillway
1 Ishino-shinden(2)	1	non(?)	?	?	non(?)
2 Watamae Shinden(3)	4	no	no	fixed frame W=2.12 m	no
3 Akagawa	1	yes	yes	fixed frame W=2.43 m	no
3A Hirono Supplemental Channel(4)					
4 Hosoya	3	yes	yes	fixed frame W=2.43 m	no
5 Daihanda	1	yes	yes	fixed frame W=2.27 m	yes
6 Gokamura	7	yes	yes	fixed frame W=2.73 m	no
7 Yokogawa	2	no	no	W=1.97 m	yes
8A Tsukegawa(5)	1	yes	yes	W=2.06 m	no
8B Tsukegawa(5)	1	no	no	?	no
9 Wanagawa	4	no	no	W=1.39 m	no
10 Yokoyama	8	yes	no	3.6 m wide gate with 2.7 m opening	no
11 Tsuchibashi	1	yes	?	W=1.27 m	no
12 Oshikiri	6	no	no	W=1.82 m	yes
13 Hirono-shinden	3	no	no	W=1.21 m	yes
14 Matsuo-kawara(6)	3?	?	?	?	?

15 Mitsubashi(6)	1?	?	?	?	?
16 Aramata(6)	3?	?	?	?	?
17 Kariyanomen(6)	2?	?	?	?	?

Notes:

1. Branch canals #1 through #13 had intakes along the Nakagawa Main Canal, while branch canals #14 through #17 were along the Tenkō Main Canal. Branch canals are listed in intake order from upstream to downstream; the numbers are used to identify the branch canals on Map 9.
2. Actually, Ishino-shinden Branch Canal was not opened until the late 1700s to serve a small area of new paddy land at the top of the main canal service area next to the Aka River.
3. Watamae Shinden Branch Canal had no sekine nor measuring pole but because its intake was only about 18 m above the intake to Akagawa Branch canal, it was always affected by adjustments to the latter's intake dimensions.
4. This supplemental channel (mashi-otoshi seki) was added in about 1718 at the time of the addition of the Hirono Branch Canal in order to increase flow in the main canal. Schematically, the supplemental channel was roughly the following:



5. These were two small, but separate, branch canals serving the same paddy fields in the village of Tsukegawa.
6. These four branch canals had intakes along the Tenkō Main Canal but very little data about them survive.

topographical depression. From an elevation of 24 meters at Shimo-mawatari, the land about 1.5 km to the north drops to 15 meters (between Matsuo and Mitsubashi Villages) before rising again to about 18.3 meters near Mitsubashi Village (and then falling steadily through the midstream and downstream sections). This depression is probably the result of an old river channel that ran west-east or east-west. Canal construction required here a raised bed of 3.5 meters above surrounding paddy fields, the repair of which we will soon see to have been a constant problem. When its condition was allowed to deteriorate, it greatly constricted the water flow in the main canals, both Nakagawa and Tenkō.

In addition to the thirteen branch canal intakes, there were eight principal structures along the main canals (see unpublished source #1). While there was no permanent gate at the intake from the Aka River, the log-frame chain weir across the river and the reinforcement to the cut in the natural levee required some technical direction and labord coordination. About 1 km along the main canal from the river intake was a spillway (Ishino Spillway) back to the Aka River. The third irrigation works was a large gate 2 km from the river intake on the edge of Shimo-mawatari Village and at the beginning of the main canal service area--Takadera daisuimon ("Takadera Great Water Gate," which I translate more freely as Takadera Intake Gate). Then, 0.7 km below the Takadera Intake Gate was the intake gate to the Tenkō Main Canal and perhaps several hundred meters below that along the Nakagawa Main Canal was the Genzō Spillway Gate, a wood-frame gate to a channel outlet to the Aka River. This was used in conjunction with the Ishino Spillway to divert excess water back to the river in times of heavy rains and flooding. Along the Tenkō Main Canal were three more irrigation works: a spillway, an overhead flume (a kakehi, in this case a raised section of the Tenkō Canal, framed in wood), and an underground siphon section (Tenkō shita-sokodo). The exact locations of the Tenkō works are not known.

Dimensions of these irrigation works, where known, are shown in Table 24. Table 25, based on a listing in Nakagawa Irrig Coop (1935), summarizes reported construction projects in the last 150 years of the domain period. Of the five irrigation works, the Takadera Main Intake Gate and the Tenkō Overhead Flume were domain public works sites, for which projects the domain underwrote half of the expenses. The Takadera Gate was rebuilt five times in the period 1830-74 (1830, 1842, 1850, 1862, 1874). A third works, the intake gate to Tenkō Main Canal, was also designated a domain public works, and one-third of project expenses were supplied by the domain (the distinction between one-half and one-third support is of unknown significance). Repairs to the Genzō Spillway and to the Tenkō Siphon were supported through assessments of labor and money or rice to the villages in the main canal service area. Presumably this was also true for the two smaller spillways, Tenkō and Ishino.

Although the project list is incomplete, it does provide evidence that there was little, if any, technical change in the manner of water delivery

Table 24

Major irrigation works along the Nakagawa/Tenkō Main Canals

irrigation works	dimensions	project support
A. Takadera Main Intake Gate	L = 9.1 m W = 5.46 m H = 2.12 m	domain public works project: 1/2 expenses from domain
B. Tenkō Intake Gate	L = 5.46 m W = 2.73 m H = 1.52 m	domain public works project: 1/3 expenses from domain
C. Tenkō Overhead Flume	L = 29.12 m* W = 2.73 m H = 1.82 m	domain public works project: 1/2 expenses from domain
D. Genzō Spillway	L = 9.1 m W = 1.82 m H = 1.82 m	all expenses from service area villages
E. Tenkō Siphon	unknown	all expenses from service area villages
F. Tenkō Spillway	unknown	all expenses from service area villagesd(?)
G. Ishino Spillway	unknown	all expenses from service area villagesd(?)
H. Aka River Intake (ichi-no-kuchi)	unknown	all expenses from service area villagesd(?)

*The dimensions of Tenkō Overhead Flume were apparently altered in 1866 to L = 32.76 m, W = 2.12 m.

Source: Nakagawa Irrig Coop 1935

Table 25

Construction and repair projects along the Nakagawa/Tenkō Main Canals

date	project	note
1715	repair/rebuilding of main canal banks	36,000 worker-days
1728	rebuilding of Tenkō Overhead Flume and of Tenkō Siphon	
1785	readjustment of branch canal intakes	
1795	*rebuilding of Tenkō Siphon	
1797	readjustment of branch canal intakes	
1803	readjustment of branch canal intakes	
1821	*repair of Ishino Spillway in 3 places	1,571 worker-days
1822	rebuilding of Genzō Spillway Gate	
1823	rebuilding of Tenkō Overhead Flume	
1830	rebuilding of Takadera Main Intake Gate, Tenkō Spillway, and Tenkō Overhead Flume	
1839	*repair of main canal banks in 12 places	6,742 worker-days**
1842	rebuilding of Tenkō Siphon	11 ryō
	*rebuilding of Takadera Main Intake Gate	126 kan
1845	*repair of main canal banks	
1850	rebuilding of Takadera Main Intake Gate	33 ryō
	placement of gravel catchment box	
1854	rebuilding of Genzō Spillway Gate	18 ryō
	rebuilding of Tenkō Siphon	13 ryō
1857	repairs to main canal banks at Mawatari	40,000 worker-days
	repairs to main canal banks at Ishino-mata	820 worker-days
1861	rebuilding of intake cut at river	20,723 worker-days
1862	*rebuilding of Takadera Main Intake Gate	29 ryō
1866	rebuilding of Tenkō Overhead Flume	
1874	rebuilding of Takadera Main Intake Gate	

*The reference in these cases is to a petition for the project, but I believe it safe to assume here that these projects were in fact accomplished.

**This figure was broken down as follows: 5,516 worker-days were requisitioned by the standard formula of 7 worker-days per 100 koku of registered yield (village unit) and the additional 1,686 were performed by special reinforcements (termed sekiko).

Source: This has been adapted from a list appearing in Nakagawa Irrig Coop 1935 and compiled from documents in the Ogawa household in Shimo-mawatari Village (former ōsekimori). The present Ogawa household head informed me in 1977 that the original documents had been thrown out at some time previously. I do not believe that the list is exhaustive of main canal projects in the period, 1715-1874.

through the domain period. There are no quantifiable data on water flow in the main canals, but a flow more insecure and unstable than that in the Shōryūjigawa Main Canal is suggested not only by the downstream intake position of the former but also by the simplicity of the river intake works itself.

Nakagawa's ichi-no-kuchi river intake was certainly nothing like Shōryūjigawa's Kumaide intake, as a technical structure or as an organizational focus. In the case of Nakagawa, maintenance and repair of the river intake was contracted out by the main canal service area villages to Mawatari Village, about 1.2 km upstream of Shimo-mawatari Village and near the river intake site. The agreement is detailed in a contract dated the third month of 1751 signed by the village headman and village elder of Mawatari for the village's forty-six registered peasant cultivators and addressed to the Kurogawa Village Group headman. In the contract (reproduced in Nakagawa Irrig Coop 1935:28-30), Mawatari villagers agreed to (continue to) undertake (a) maintenance and operation of then river intake, (b) maintenance of the main canal from the river intake down to the Takadera Main Canal Intake Gate (e.g., dredging, canal bank repair), and (c) setting out the log-frame weir across the river in the summer dry months. They agreed to work under the direction of the Main Canal Guard (see below) and to supply all needed materials as well as labor for the maintenance. The contract included a proviso that in case of serious flood damage and major repairs, upon inspection, the service area villages were to send materials and labor (i.e., Mawatari agreed to undertake ordinary maintenance and operation only). They were to receive an annual payment of eighty bags of rice (32 koku), payable in rice coupons. The contract was endorsed by the Kurogawa Village Group headman and sent to the Aragawa, Yokoyama, and Oshikiri Village Group headmen, presumably for circulation to the service area villages. This routing of the contract did not necessarily involve the domain authorities in specific obligations to insure compliance and/or entertain complaints, but it did create a formal and public agreement which assumed the weight of precedent. There are, however, no records of disputes concerning this arrangement, throughout the domain period.

There were four maintenance and operation roles specific to the main canals (Nakagawa and Tenkō). There were two Main Canal Guards (ōsekimori), one at the top end from Shimo-mawatari Village and one at the tail-end from Yokoyama (-kamigumi?) Village. The Shimo-mawatari position was always held by the head of the Ogawa household, a peasant cultivator household in the village. It is not clear whether the Yokoyama position was also in fact hereditary. There was also a Tenkō Main Canal Guard from Mitsubashi Village[73] and a gate guard at the Genzō Spillway.

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[73] This role was also referred to as "Tenkō Intake Gate Guard."

From the references to the Main Canal Guards in the documents discussed below, I would characterize their role as one of first-order responsibility for water flow and main canal maintenance (the Takadera Intake Gate and main canal channel and banks) and authority to coordinate gate rebuilding, canal bank repair, and canal dredging. By "first-order," I mean that their responsibility was not total nor their authority complete. In the event of poor channel maintenance, village headmen would complain to the Main Canal Guards; if satisfaction was not forthcoming, they would address domain authorities through the village group headmen. And, an agreement reached at a meeting of service area village officers in March of 1832 for that spring's main canal dredging implies that the Main Canal Guards were delegated the authority to coordinate such maintenance under terms specified by the service area villages; the 1832 agreement stipulates the number of workers and sections of the canal to be cleaned by each village (Nakagawa Irrig Coop 1935:42-4).

Annual maintenance costs for the main canals in the late 1700s and 1800s totalled 103 bags of rice or 41.2 koku for the following items:

intake costs (Mawatari Village)	32.0	koku
Chief Main Canal Guards (2 persons)	8.0	koku (i.e., @ 4 koku)
Tenkō Main Canal Guard (1 person)	0.6	koku
Genzō Spillway Guard (1 person)	0.6	koku
Total	41.2	koku

These expenses were assessed to all service area villages as a fixed percentage of registered yield.[74] By the mid-1800s, when the registered yield of paddy land in the service area reached 17,000 koku, each village was assessed at the rate of 0.0242 koku per 10 koku of registered paddy land (i.e., 0.00242%). Collection was at the end of each year at the time of domain tax payment accounting and was handled through the village group headmen. The assessment by village group was:

Yokoyama Village Group	27.4575	koku
Aragawa Village Group	7.4803	koku
Oshikiri Village Group	4.4921	koku
Kurogawa Village Group	1.7700	koku
Total	41.1999	koku

(source: Nakagawa Irrig Coop 1935:44-6)

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74 Although the 41.2 koku in maintenance expenses were assessed equally through the service area, the 1832 dredging agreement (the only such document surviving) divides the Nakagawa Main Canal among 23 villages from Daihanda down to Yokoyama. That is, villages upstream from Daihanda and downstream from Yokoyama (including Oshikiri and Hirono with long branch canals to maintain) had noddredging assignments that year.

In addition, the main canal was apparently dredged once a year in the spring, requiring from five to thirteen workers per village, and for major repairs, villages would be assessed additional workers and rice or money for project expenses. Still, the cost of water, i.e., the burden of maintenance on service area villages in the Nakagawa network, would appear to be very low: by any standard, 0.00242% of registered yield is paltry.

Even when branch canal expenses are added, the total maintenance burden on water users does not appear to have been onerous. As an example, Higashi-watamae in 1845 was a village whose lands were in the service areas of at least two large branch canals at a time when materials and wages were at high levels. The total village registered yield was 381.9835 koku. The principal land tax, at 32%, amounted to 122.2348 koku; with over twenty miscellaneous taxes and the required leakage and inspection surcharges, the total tax due the domain that year was 212.7691 koku (56% of registered yield). Included among the miscellaneous taxes was a 10.3631 koku domain public works (gōfushin) levy (a 2.7% tax rate). In addition, there were other categories of taxes payable by the village and itemized on the village-prepared accounts (nengu-wari motokime-chō) but which were collected and distributed by the village group headman and district deputy's office and thus kept separate (as torichō gai or torichō hazure) from the total going to the main domain accounts. These included all the irrigation expenses beyond the public works levy. The following items appear on the Higashi-watamae accounts:

Main canal assessment	0.3726 koku
Assessment for Gokamura Branch Canal	
Guard salary & benefits*	0.4738
Assessment for Shinden Branch Canal	
Guard salary	0.1969
Annual indemnity payment for land	
used in Gokamura Branch Canal	0.4037
Payment in lieu of workers (main canal)	0.8052
Payment in lieu of workers (Gokamura)	0.1160
Total	2.3682 koku

*Salary of the Gokamura Branch Canal Guard was 2 koku; in addition he enjoyed at least a partial tax exemption on 11.875 koku of land (that is, the service area villages paid the taxes for him).

In sum, the total irrigation-related expenses for Higashi-watamae that year were 12.7313 koku, representing 5.5% of its total taxes and 3.3% of the village total registered yield. Computations for several other villages in other years in the nineteenth century yield figures in the same range (based on Naganuma 1964:452-6).

Along the Nakagawa Main Canal, there were at least three revisions of branch canal intake dimensions and structures--in 1785, 1797, and 1803

(see Table 26). Documents from these and other years shed some light on allocation and conflict at the main canal level, and the remainder of this section will introduce them briefly.

On May 31st of 1785, a petition signed jointly by eleven village headmen from Hirono-shinden, Doguchi, and Oshikiri area villages was sent to the headmen of Yokoyama Village Group and Naganuma Village Group (the latter was doubling at the time as Oshikiri Village Group headman). In order to give a more concrete sense of Aka River irrigation documents, translations of the petition and of related 1785-6 documents are appended to this chapter. Except for Doguchi Village, at the tail-end of Yokoyama Branch Canal, the petitioning villages were attached to the two tail-end branch canals, Oshikiri and Hirono-shinden. They complained that water shortages in their areas, common in recent years, were especially severe this year (it was at the time of transplanting). They had complained to the main canal water guards, who replied that these shortages were due to the weakened condition of the main canal banks in the hako-no-uchi section, the stretch of the canal between Matsuo and Mitsubashi elevated above the surrounding land. The canal guards claimed that to let more water in through the Main Intake Gate threatened the collapse of the canal banks in that section.

The petition continued that the petitioners themselves had then assembled and conducted their own survey of the main canal, discovering that the branch canal intake at Mitsubashi Village (i.e., to #2 Watamae Shinden Branch Canal) and those farther down were taking in too much water. They believed the spring dredging by each branch canal at its intake had deepened the intake and was allowing an excess intake volume--such that water reaching their branch canals at the tail-end was now 15.2 cm below normal. The petition closed with a request that domain officials survey the various branch canal intakes and that construction be undertaken to strengthen the hako-no-uchi section.

Redress was soon forthcoming from the district deputy's office, and action was taken on two levels. The following day, June 1st, Tōzō, an assistant in the district deputy's office (and no relation to the Futakuchi Tōzō), surveyed the main canal after summoning the main canal guards, the village group headmen of Yokoyama and Naganuma, and other (unspecified) village officers. Agreeing with the petitioners, he ordered changes in intake dimensions and/or structure of seven branch canals, from #3 through #9 (see Table 26 and Appendix for details). His written order was endorsed the same day by Ueno Wakichi, another official in the district deputy's office,[75] who sent the order out to be circulated among headmen of the upstream villages. The latter were told to send one person

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[75] My speculation here is that Ueno Wakichi was a warrior-rank assistant (tedai) directly under the district deputy while Tōzō was an assessor-foreman (waritsuke), a peasant-rank post.

Table 26

Adjustments in branch canal intakes ordered by domain officials

branch canal	1785 inspection adjustments	1797 inspection adjustments	1803 inspection adjustments
#2 Watamae	none	none	none
#3 Akagawa	main canal widened .09 m to 1.3 m	makura lowered 6.1 cm	intake narrowed .4 m to 2.0 m
#3A Hirono Supplemental Channel	none	none	widened .3 m to 1.6 m
#4 Hosoya	main canal widened .24 m to 3.9 m	makura lowered 12.2 m	spillway installed 1.82 m wide
#5 Daihanda	main canal widened .09 m to 3.7 m	makura lowered 6.1 cm	main canal widened .3 m to 4.0 m
#6 Gokamura	main canal widened .5 m to 4.2 m; makura lowered	makura lowered 9.1 cm	main canal widened .3 m to 4.5 m; 1.8 m spillway installed
#7 Yokogawa	no fixed dimensions; spillway widened .6 m to 1.2 m	none	none
#8 Tsukegawa	top layer of sand bags in main canal removed and makura leveled	makura lowered 6.1 cm	main canal widened .3 m to 3.9 m
#9 Wanagawa	buried log removed from main canal bed	none	none
#10 Yokoyama	none	none	none
#11 Tsuchibashi	no fixed dimensions	none	none

Source: unpublished source #1

each to their respective branch canal intakes on the 3rd to make the necessary adjustments.

As described for the Shōryūjigawa network, intakes along the Nakagawa Main Canal to branch canals varied widely in the complexity of design and permanency of structure, and Tōzō and Ueno Wakichi attempted to increase the flow to the tail-end branch canals by means of several kinds of adjustments. At those intakes where there was a lined main canal bed (sekine), they either ordered it widened (#3, #4, #5), ordered the "pillow" weir (makura) lowered (#8a, where the top layer of sand bags was to be removed), or required both adjustments (#6).[76] At intake #7, where the main canal had no fixed and lined sekine, the spillway in the branch canal was to be widened 60.6 cm, and at #8b and at #9 (both without a sekine) a square log was either buried in front of the branch canal mouth (#8b) or removed from the main canal (#9).[77] The officials in their orders ignored the petitioners' request to strengthen the hako-no-uchi section of the main canal.

Thus, it would appear that the officials were exercising an authority to alter dimensions of structural elements of branch canal intakes where they existed, but they either did not choose or did not have the further authority to change the intake structures; they could order a sekine to be widened but they could not (or at least did not here) order a sekine-- that is, order the lining of the main canal at the intake point-- where it did not exist.

In addition to adjustments made along the main canal, the district deputy officials also took action on the branch canal level, admonishing the petitioning villages for poor maintenance and water stealing. They noted that along the Tsuchibashi Drainage Canal[78] and along the banks of both Oshikiri and Hirono-shinden Branch Canals there were bushes and trees growing out into the canal and obstructing water flow; they ordered that these be cut and that collapsed sections of the banks be repaired (see

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[76] In the case of Gokamura Branch Canal (#6), a new measuring pole had recently been positioned beside the old one with a minimum main canal water level mark 12.1 cm lower than the mark on the old pole. The officials ordered that the old pole remain, that a makura be laid in the main canal, but that the main canal itself be widened.

[77] The structure here is obscure. The term su-no-ki I have interpreted as a variant of su-no-ko, which itself has several meanings. I here take it to mean a square wood log.

[78] At some point in the 1700s, Hirono-shinden and Oshikiri area villages had built a channel from Tsuchibashi Village to the tail-end of the main canal in order to use the drainage of Tsuchibashi (for which they paid the latter 2 koku per year).

documents C and D of Appendix). Then they noted that where the Hirono-shinden Branch Canal passed through Tsushima, Sanbongi, and the Oshikiri Villages, cultivators of the latter villages were digging into it and drawing off water for their own fields. They summoned village officers from both Hirono-shinden and Oshikiri areas; the latter were told to have these cuts filled in and the former were told to make sure that this was done.

There were continued problems with Oshikiri Branch Canal in the spring of the following year (1786) which directly drew in deputy officials. Complaints reached them that within Oshikiri Branch Canal itself, cultivators in the upper-end villages (Tsushima, Sanbongi, Oshikiri-kamigumi) were drawing in extra water from the branch canal and causing shortages in the tail-end section (Oshikiri-shimogumi, Fukuoka, Ōfuchi). A meeting was held with the Yokoyama and Oshikiri Village Group headmen following an inspection by a domain official. Among thed directives to the villages (via the village group headmen) was a charge to conduct all new construction and repairs along the branch canal only after meetings of officers of all villages (see document E in Appendix).

The shifting patterns of coordination and contention here are familiar from the Shōryūjigawa network. Oshikiri area villages joined with Hirono-shinden area villages to complain about main canal upstream allocation at the same time as Oshikiri area cultivators were taking water out of the Hirono-shinden Branch Canal, leading to a series of complaints and counter-complaints between Oshikiri and Hirono-shinden Branch Canal Villages (the continuation of which we will take up again below). But this in turn was simultaneous with problems along Oshikiri Branch Canal itself, between upstream Tsushima, Sanbongi, and Oshikiri-kamigumi and downstream Oshikiri-shimogumi, Fukuoka, and Ōfuchi.

At least at this point in time, domain officials were responsive to each of these problems, though their involvement varied. Along the main canal, they exercised limited authority to adjust allocation to the branch canals, but in the matters of Hirono-shinden and Oshikiri Branch Canals, they intervened only to exhort proper canal maintenance and prescribe adherence to standards of proper conduct, preferring to leave details to the village group headmen and the village officers. To be sure, their order to close improper cuts in the Hirono-shinden Branch Canal by Oshikiri cultivators, for example, was no doubt the normative basis for subsequent action by the village group headman and the Hirono-shinden Branch Canal water guard to close them up, but problems in later years imply that such orders were not often effective deterrents to water stealing.

In May of 1797, officials in the district deputy office again responded to a petition from main canal service area villages concerning alleged water shortages, and the problem again appears to have been associated with limitations on flow volume resulting from the rather delicate

hako-no-uchi section. The document which survives is the directive issued by the district deputy office on May 13, 1797, following a petition and survey. This time, the petitioners, apparently from the midstream villages, requested that they be permitted to shift upstream the intakes to Watamae Shinden (#2), Hosoya (#4), Daihanda (#5), and other branch canals; that is, at the time, the intakes were downstream of the hako-no-uchi section; if they could be moved upstream of the section, more water could be drawn in through the river intake.

This proposal drew opposition from Akagawa and Matsuo Villages, which probably feared loss of paddy land (to move the intakes upstream would require extending the branch canals through their paddy lands). The domain officials sought a compromise. No changes were allowed in intake positions, but rather the makura of five branch canals were to be lowered. The branch canals affected were #3, 4, 5, 6, and 8a (see Table 26 for details). While this would have the effect of reducing relative intake volume to these branch canals, this would be compensated for by an increase in the volume of intake to the main canal at the river.

I suspect the reasoning behind this approach to have been as follows. The hako-no-uchi section of the main canal, with banks above the surrounding land, was the weakest stretch in the main canal, and the volume it could handle set an upper limit on potential main canal volume. The problem was aggravated by the fact that several of the major branch canal intakes were just downstream of this section. Each would set out a makura in the main canal to improve the flow to its intake, the effect of which would be to slow the velocity in the main canal and raise the water level. When done at four or five consecutive points, the cumulative effect would be that water would back up into the hako-no-uchi section. If all of these branch canals would lower their makura height, main canal velocity would increase and a greater total volume could be accommodated through the hako-no-uchi section. If all the makura were lowered in coordinated fashion, none would suffer a proportional loss of intake volume. Nor, with an increased total volume, would any suffer an absolute loss of intake volume.

Such were the measures taken by the district deputy officials. It is not known how happily they were received by the service area villages, but the next surviving documents--from six years later, in 1803--again raised problems attributed to the hako-no-uchi section. The year before, perhaps after harvest, a considerable number of workers from the villages in the service area[79] had made repairs and reinforcements to the hako-no-uchi

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[79] The number is not specified, nor does the project appear on the list reproduced as Table 25, but the directive refers to the need not only for the regular assessments of workers (i.e., 7 per 100 koku of registered yield) but also for supplemental workers (here, termed sunshi-ninsoku).

section, and as noted in a directive from a domain official (in the district deputy office) of April 16, 1803 to the village group headmen of Yokoyama and Aragawa, it would now be possible to increase the spring flow volume in the main canal. Indeed, a survey by Ueno Wakichi of the office on the 18th had determined that water was now flowing in the main canal at 18 cm higher than the spring measuring pole mark. The directive went on to order further adjustments--namely, a widening of the main canal (sekine) at five branch canaldintakes (#3, 4, 5, 6, and 8a).[80]

Three times, then, in 1785, 1796, and 1803, domain officials surveyed and adjusted the intake structures along the main canal, primarily by widening the main canal at the point of intake and only occasionally by narrowing the intake entrances themselves or widening the spillways back to the main canal. In each case, the precipitating problem--water shortages in the downstream areas during rice transplanting (when the maximum volume was required)--was linked to the constrictions on main canal volume of the hako-no-uchi section just above the #2 branch canal intake. Only in 1803 was this addressed directly; later documentary evidence--concerning an altercation in 1857--implies that the resolution had not been of lasting satisfaction to downstream cultivators.

On July 4, 1857, heavy flooding caused considerable damage to the west bank of the main canal from the Takadera Main Intake Gate to an unspecified point downsteam. This necessitated repair which received domain support as a public works project (see Table 25) and which was completed within a few weeks. By late July, canal volume was back to normal, but the Oshikiri area villagers found that no water was reaching them. So on July 23rd, a group of them, with straw mats and bags, went up along the main canal to the site of recent repairs and made further improvements around the Matsuo Village area, returning the same day to their villages.

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[80] In the case of Akagawa Branch Canal (#3), the widening was of the Hirono-shinden Supplemental Channel; in addition, the Akagawa Branch Canal intake itself was narrowed by 0.39 m, and at Hosoya Branch Canal, spillways were dug back to the main canal below the intake. These changes did not meet with universal satisfaction. Two years later, at the end of 1805, village officers of Higashi-watamae complained bitterly to an unknown domain official that the adjustments of 1797 and 1803 had caused continual water shortages and poor harvests in their area. While Watamae Shinden Branch Canal was not itself subject to the adjustments, the changes in main canal width and makura height at Akagawa Branch Canal intake (just below the Watamae Shinden Branch Canal intake) had greatly affected the latter's intake volume as well. They asked for a return to the old dimensions and were refused (Kelly 1980:431-434).

This is recounted in a written reply to an official investigation, signed by headmen of Oshikiri area villages and sent to three village group headmen on July 25th.[81] On the previous day (the 24th, the day following the repairs), Oshikiri cultivators discovered that water still was not reaching them and a "large crowd" assembled and went up along the main canal to the Chief Main Canal Guard at Shimo-mawatari. They demanded to speak to him but were unable to, either through his absence or unwillingness. As evening came, they were alleged by other officials[82] to have created a disturbance of sufficient proportions to cause a report to higher officials. The village group headmen were charged with investigating the incident, and the only document now available is a reply by Oshikiri area village headmen. In it, they claimed that the water shortage even following the domain-sponsored repairs was quite real and admitted that a large number of villagers did go up to talk to the main canal guard, but they protested that their villagers had not displayed any of the unruly or disorderly behavior reported. As with most such cases, the incomplete documentary record precludes knowledge of the outcome, although even this fragment demonstrated the continuing problem at the main canal level of maintaining a volume sufficient to supply the tail-end branch canals. The next section details one of the consequences of that, friction between Oshikiri and Hirono-shinden Branch Canals.

A critical but unfortunately missing piece of evidence in interpreting domain officials' actions at the main canal level is a clear statement of the principle of allocation used to determine the adjustments in intake dimensions. There are no documents or references to documents comparable to the 1658 registry of the Shōryūjigawa Main Canal, for example. However, a reference by Ueno Wakichi in a matter concerning Oshikiri Branch Canal to customary allocation by registered village yield (mura-daka) and the use in the 1785 documents (#C in the Appendix) of the phrase "allocation according to proportion" (wariai no bunsui) and in the 1797 document to "allocation according to the master proportions" (ōwariai no bunsui) recommend the proposition that there was an official norm of allocation of main canal water proportional to registered paddy land yields by village unit. This is also implied in the use of the phrase "mutual adjustments of the branch canal intakes" (mido awase) by district deputy assistants in both 1797 and 1803.

One must, however, entertain considerable doubt about the application of this norm. It did not operate easily and unambiguously, and it is safer to assume that actual allocation varied widely from that norm rather

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[81] This document (unpublished source #4) was copied for me by Maeta Teruhiko from the original in Oshikiri Village.

[82] The reference is to "officials" deployed near there at a public works project site--probably labor foremen anddother lower assistants of the district deputy's office at the site of a canal repair project.

than corresponded closely. This is because one must see the norm operating in conjunction with at least three other circumstances.

There was first of all the technical difficulty of translating such a principle of proportional allocation into concrete adjustments of dimensions and structures, compounded by the apparent fact that while expertise in making such structures lay with the main canal guards, such authority lay with the district deputy officials (a conclusion I draw from the hereditary nature of the main canal guard post and the transiency of domain official posting--Ueno Wakichi is the only district deputy official whose name reoccurs). Acceptance of the adjustments (the translating job) depended on both domain certification and peasant satisfaction.

Application of the norm was further complicated by a conservative regard for customary form and precedent--the obverse of a healthy skepticism toward disturbances to the status quo. The reluctance of the domain officials to attack directly the problem of the hako-no-uchi section reflected a reluctance to involve domain authority and finances in what might become a continuing and burdensome precedent; it might also have reflected a reluctance by the individual official to attach his name to an order of such consequences. As a result, the physical system tended to be modified by accretion rather than replacement, which in turn had the effect of further complicating the network. The supplemental channel dug at the Akagawa Branch intake for Hirono-shinden and the channel dug from Yokoyama Branch Canal back over to the Hirono-shinden Branch Canal intake to supplement water for Okui-shinden both illustrate this characteristic accretion.

Finally, the context of any allocation adjustment included certain features of land tenure in the domain, notably the widespread, though differentially occurring, under-registration of paddy lands in the service area. Distribution of water was not unrelated to distribution of land, and it would not be surprising to find the fervor and explicitness with which allocation petitions were presented to be colored by an unwillingness to risk attention to one's land rights for uncertain, tenuous success in improving one's water rights.

These considerations remind us that rather than simply compute the divergence of actual water allocation from announced norms as a variant feature of water delivery systems, it is more instructive to see such a norm operating in conjunction with other factors to account for the pattern of allocation. For the Nakagawa network, these other factors of course were the same we have seen operating in the Shōryūjigawa delivery network. They constitute, I believe, basic features of Aka River irrigation in the Tokugawa period.

Irrigation matters along the branch canals

By the eighteenth century, there were seventeen branch canals in the Nakagawa service area, thirteen with intakes along the Nakagawa Main Canal and four with intakes along the Tenkō Main Canal. Without a listing comparable to the Shōryūjigawa 1658 registry, exact figures for branch canal service areas cannot be determined, but they ranged from small branch canals such as Akagawa, Tsuchibashi, Daihanda, and Tsukegawa, serving lands in one or twodvillages with registered yields of 400-600 koku (i.e., 60-80 hectares), to large branch canals such as Gokamura and Yokoyama, serving six to eight villages with registered yields totalling perhaps 2000 koku (about 400 hectares). This section analyzes several sets of documents for the data they may yield on irrigation tasks at this branch canal level.

We have already had some sense of the problems faced by the two tail-end branch canals, Oshikiri and Hirono-shinden, in the events of 1785-6 discussed above. Their joint petition for increased water flow in the main canal was entertained by the district deputy's office; the response included not only a readjustment of intakes along the main canal but also orders to improve maintenance along the petitioners' canals and to cease improper water diversions from the other's canal.

As Map 10 shows, both Oshikiri and Hirono-shinden began at the end of the Nakagawa Main Canal, at a place just above Yokoyama-kamigumi known as Kamenoyama. Oshikiri Branch Canal was the earlier, dug as an extension of the main canal in the 1620s or 1630s (YKS 1980:546) to deliver water to the paddy lands of the new settlements of Tsushima, Sanbongi, and Oshikiri. The settlements themselves were built along the Aka River bank and the paddy lands opened up in the low wetlands to the east, between the Aka and Fujishima Rivers. Oshikiri Branch Canal ran through the villages, with most tertiary laterals extending east into the paddy lands and drainage eventually flowing north into the Fujishima River. In 1662, the former Yokoyama Village Group headman, Satō San'emon, received domain permission to extend the line of development north from Oshikiri (which, like Yokoyama, divided into three separate administrative villages, Kamigumi, Nakagumi, and Shimogumi). The result was Fukuoka and Ōfuchi at the tail-end of Oshikiri Branch Canal.

Hirono-shinden Branch Canal was constructed about fifty years after this, when the last remaining extensive tract of wetlands in the drainage basin was developed (see chapter two above). Hirono-shinden Village was founded in 1714, and by 1718, the villagers had completed a canal from Kamenoyama at the tail-end of the main canal (the canal project cost about 100 ryō or 50 koku of rice, 3.3% of the total expenses of 3000 ryō). They installed an intake gate and a spillway to the river and also built a small hut there. A villager was paid 2.8 koku of rice per year to live in the hut during the cultivation season; his job was to regulate water flow, supervise maintenance, and prevent disruptions of flow by Oshikiri area

villagers (see Map 9).[83]

To maintain a high elevation and avoid the already developed paddy lands, the Hirono-shinden Branch Canal was run along a close parallel to the Oshikiri Branch Canal, between it and the Aka River. As such it passed through the Oshikiri area villages. The strained relations generated by such a layout are illustrated in events of 1811-12. On May 13th and 14th, 1811, Hirono-shinden Branch Canal irrigators dredged their canal from the intake down to Kōya-shinden (from which various tertiaries took off). They discovered a number of transgressions by Oshikiri area villagers and appealed to the district deputy's office. In a directive dated the 14th from Ueno Wakichi and the Yokoyama Village Group headman ton four headmen of Oshikiri area villages, the following were ordered:

a) the bridges in front of Oshikiri area houses across the Hirono-shinden Branch Canal were too low and were to be raised to 1.82 m;
b) Oshikiri villagers had been putting freshly cut logs in the canal to soak and cure--these were all to be removed;
c) the villagers were digging small channels from the branch canal around their houses for domestic uses--this was to cease; and
d) tree and brush growth along the canal banks and in the canal bottom was to be cut out (unpublished source #1).

Ueno and Satō had based these on a survey they had just made. They noted that essentially the same orders had been handed down in 1797 and that apparently people had become negligent again. The village headmen were to transmit these to all villagers.

Another source of friction was the intake area at Kamenoyama and in April of the following year (1812), Hirono-shinden villagers, on the occasion of rebuilding their intake gate, accused Oshikiri Branch Canal irrigators of over-dredging the channel leading past their intake to the Oshikiri Branch Canal. This again led to the intervention of Ueno Wakichi

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[83] Development of the downstream Hirono area proceeded in stages throughout the eighteenth and nineteenth centuries; indeed, paddy lands were still being developed in this century. Retarding development was not only the difficulty of draining the low-lying marshlands but the frequent flooding of the Aka and Kyōden Rivers. Where development was possible, paddy lands were either attached to the Hirono-shinden Branch Canal by tertiary laterals or, in the very downstream section, irrigated from one of the two remaining swamps in the center of the area (around which earth embankments had been constructed to impound water). Okui-shinden, founded in 1788 with domain permission by a Tsuruoka merchant, was attached to Hirono-shinden Branch Canal. To supplement water supply, a channel was dug from Yokoyama Branch Canal over to Hirono-shinden Branch Canal.

of the district deputy's office and the village group headmen. Based on a survey by a person who appears to be of the district deputy's office (but not Ueno), a meeting was held with village officers of both branch canals, and a written summary of the agreement--in the form of a directive from Ueno and the two village group headmen to Hirono-shinden and Oshikiri area village headmen--was drawn up that day (unpublished source #1; see map 9). The result was (a) the construction of a more permanent, stone-lined channel (an ishi sekidai) at the divergence of the two branch canals, (b) the installation of a measuring pole at that point, and (c) establishment of procedures for maintenance and repair of the two intakes. The last included admonitions against dredging along the new sekidai section (i.e., below the stone lining) and the order that all repairs to the one intake should be undertaken with the consent and agreement of village officers from the other intake's service area.

The difficulties between Oshikiri and Hirono-shinden Branch Canals are but another example of the ways in which the physical network of delivery, the pattern of land tenure and the general administrative framework constrained coordination and conflict on the local level and limited the effectiveness of intervention by domain officials. Although evidence has not been located yet for post-1812 disputes between the two branch canals, it seems reasonable to assume that the 1812 directive did not constitute a final resolution. Given the canal configuration, some disruption of flow in Hirono-shinden Branch Canal was always likely, although the necessity for coordination between irrigators of the two branch canals vis-a-vis the main canal problems could impel village officers and canal guards to try to contain the extent of transgressions. At the same time, there was a limit to what action a minor official such as Ueno Wakichi might take when trouble led one side or the other to petition for redress. More active involvement in the form of investment in facility improvement (e.g., a widening and lining of sections of the branch canals) or in the form of direct and vigilant enforcement of the directives would find little or no support form higher officials (lacking financial and personnel resources and the disposition to so use them) or cultivators themselves (for their repercussions on other water delivery levels and on other administrative and land tenure relations). As in most cases, his involvement was reflexive and cosmetic.

The events in 1797 discussed in the main canal section also suggested potential friction within Oshikiri Branch Canal itself, and this finds further illustration in an incident towards the end of the domain period, in the summer of 1850. There were seven villages along the Oshikiri Branch Canal, and within the territory of each there were many small laterals running to the paddy lands (generally east of the branch canal). From a fragment of a branch canal rotation schedule (OB 1974:157), it would appear that in the summer dry months, tertiaries along the branche canal were divided into three sections and allocation was made to each section on a time rotation basis. The rotation went from upstream Tsushima and Sanbongi area tertiaries to the three Oshikiri Villages'

tertiaries and then to the downstream section of Fukuoka and Ōfuchi Village tertiaries.[84]

The incident in 1850 concerned an apparent violation of this dry season rotation along lines rather easy to anticipate (see the document in OB 1974:162-3). On a day in early August, the upper section (i.e., the Tsushima and Sanbongi tertiaries) received its allocation. The following day was to be the turn of the three Oshikiri Villages, but there was no water reaching them. At this, Taroemon, an Oshikiri-shimogumi cultivator who was serving as rotation coordinator (mizu-ban), went up along the canal and discovered two places in Sanbongi where the flow was stopped up and diverted. As he broke down the weir, a "large crowd" (ozei) of Sanbongi villagers descended upon him, took hold of him, and demanded payment for the boards, straw rope, etc. he had "destroyed" in breaking up the weir. He was brought before the village headman and roughed up a bit, though not beaten. At last he was released and started back down the canal, only to be apprehended again by three men who chased after him from Sanbongi.

They claimed that they were ordered to lead him back to the village, allowing him to stop off at a kinsman's house in Tsushima to have the latter inform Oshikiri-shimogumi villagers of his problem. They then continued their return up the canal to Sanbongi, but before reaching the village, the three proposed to Taroemon that they would release him at that point and save him the rough treatment in the village if he would pay them 500 mon in copper coins; when he refused, they suggested 400 mon. Taroemon replied that he had no such money, whereupon they led him back to his relative's house and demanded of the latter that he pay the 400 mon or at least guarantee its payment by the next day. The kinsman refused, but Taroemon, afraid of being led back to Sanbongi, prevailed upon him to pay the money.

Upon his return to his village, Taroemon reported the events, and a large crowd of fellow villagers went up to the Sanbongi Village headman's house to confirm the truth of the story. The headman did so confirm it, arguing that the money was in payment for materials destroyed. In subsequent discussion among themselves, the Oshikiri-shimogumi villagers decided that the matter did not warrant the attention of higher authorities. The following day, therefore, village officers, together with Taroemon, returned to Sanbongi to negotiate a settlement. They were told, however, that the headman was absent and that there were no village officers who would see them.

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[84] This was a bansui rotation, but without the entire schedule, it cannot be confirmed whether time allotments were proportional to registered yields.

All of this is recounted in a petition from Oshikiri Village officers to the village group headman later in the summer (ibid.). The altercation with Taroemon had been dropped but repeatedly during the dry summer, the petition alleged, other rotation coordinators had been similarly treated and the Oshikiri allocation disrupted by Sanbongi villagers. Thus they were driven to request assistance of domain officials.

The response of the district deputy's office, if indeed it reached that far, is unknown. One may speculate, though, that as with similar incidents around Kakuda-futakuchi, it would have been no more than an order that Sanbongi pay some modest damages and an admonition that such breaches of the rotation cease. Sanbongi may even have lost a turn in the rotation (if the petition was handled with dispatch and it was still the irrigating season) but there is no case on any level of the delivery networks where an offending party lost the right to a turn. A higher value was placed on restoration of the status quo than on the retribution for wrongdoing, where both parties were peasant cultivators.

Field and ditch patterns of Watamae: water use in the canal networks

Thus far, we have dealt with how the various tasks of water delivery and water drainage were handled within the two canal networks. It remains to consider the organization of water use at the terminal level, the tens of thousands of small field parcels that constituted the networksd service areas. Unfortunately, water use is the phase of irrigation for which we have the least evidence; at this point, I can only offer a few inferences from limited data and hope to improve upon them with further archival research.

In the Aka River basin, indeed throughout Japan, the japonica rice varieties have always been cultivated in check basins (suiden, ta, tanbo). In the Tokugawa period, these were small, irregular parcels of land, averaging one or two hundred square meters, encircled by a low earth ridge (a bund), with a hard pan soil layer about 30 cm below the soil surface. Each had a miniscule grade of several millimeters to allow water flow from an intake cut in one bund to an outlet cut in the opposite bund.

The cultivator growing rice in such a check basin parcel faced a dilemma in using water. On the one hand, given the nature of water demand and cultivation methods, optimal water use entailed a high degree of freedom of intake and outlet for each parcel; yet the field and ditching patterns that developed in the basin necessitated close coordination of water use among blocks of parcels. I will illustrate this dilemma here with details of field and ditching in an area of Watamae before turning to the implied question of what forms such coordination might have taken.

As we saw in chapter three, the amount of water used in the paddy parcels was a function of both natural and human factors. The type of soil strongly affected water percolation rates but of equal importance was the way the check basin was constructed and maintained. The tunneling of field mice, untended plant growth, and their use as footpaths among the parcels all damaged the bunds; tilling too deeply and inadequate drainage could weaken the hard pan soil base. Thus, diligent upkeep of the bunds and hard pan was essential in reducing water losses through leakage.

Moreover, while there was a minimal water requirement for direct cultigen growth, water was equally critical in the check basin parcels for a wide range of uses: to prepare the soil, to regulate temperatures around the plants, to replenish soil fertility, to promote rooting, and so forth. These multiple functions meant that water use was highly elastic.

It was also variable through the growing season. Chapter three has shown that for the spring "planting water," large but relatively fixed volumes were needed; applying the correct amount to each parcel was important in wet tilling for proper soil consistency and in transplanting for supporting (but not drowning) the seedling and for protecting it against low temperatures. The water in both periods was ponded on the fields so drainage was not of much importance. Timing, though, was critical to coordinate seedling growth in the nurseries, field preparation, and available labor.

For the summer "nurture water," much smaller but more variable volumes of water were consumed; the timing and extent of water level adjustments were coordinated not with labor but with the weather and the rice plant cycle. Good drainage was a requisite for optimum "nurture water" applications.

To the degree, then, that water could be manipulated in such elastic and strategic ways, yields improved and, perhaps more importantly, stabilized. Yet such procedures entailed a high degree of freedom to take in and discharge water from individual parcels. This was the difficulty for the cultivator, because the actual geography of fields and ditches suggests limits to the freedom a water user might enjoy and a need to coordinate intake and outlet on an inter-parcel level. The ways in which parcels and ditching interlocked is illustrated in two maps of a section of fields in the Watamae area of Nakagawa (Maps 11 and 12). These are based on on-site mapping done in 1894 to a scale of 1:600, prior to a major field adjustment project. Because this was after the 1875 land tax surveys, the maps are probably fairly accurate; there is no evidence of land alterations between the end of the Tokugawa period and 1894 (and Map 11 agrees broadly with the delivery map drawn up in 1806), so I assume they approximate field conditions in the late Tokugawa period.

As Map 11 demonstrates and as was discussed above, paddy lands within the boundaries of the two Watamae villages were connected to three

separate branch canals of the Nakagawa MaineCanal; we can see clearly the joint delivery-drainage functions of the canals and the interlocking of tertiary canals and terminal ditches of separate branch canals. Map 12 details one section of these lands, bordered by channels from two of the branch canals. Channel B2 is the tail end of Oki Tertiary Canal from Watamae-shinden Branch Canal; channel A1 is the tail end of a tertiary from Aramata Branch Canal. Topographic lines and water flow directions are not indicated on the original maps, but it appears that this section was irrigated from water from channel B2; channel A1 carried discharge from fields above this section to the river just below it. Channel X seems to have been a drainage canal collecting water from the fields in the top half of the section on the map and discharging it into the Fujishima River to the east. The channels were all about 0.9 to 1.2 meters wide with approximately 1 meter banks (dote) on either side. There were 'public' paths of a standard 1.82 meters width.

The thin lines of the map are the bunds between field parcels. Here we must distinguish between the hitsu and the osa, both of which meant "parcele" The map shows the borders of the hitsu, which were parcels surveyed by a domain official, registered in the cadastral registry, and assigned to a single cultivator. The map suggests that even in a single section of fields, the size of hitsu parcels varied widely, from less than .01 ha to .7 ha. We are probably correct in assuming that at least some of the small parcels were seed beds. The largest parcels were quite big even by present-day standards, and for cultivation, it was necessary to sub-divide them (i.e., in such a large area, it was impossible to grade the soil level enough for water application)e These sub-divisions were known as osa, and while the bunds which bounded the hitsu parcel (the aze or kuro) were fixed by domain directive, the cultivator was free to adjust the smaller inner bunds (nakaguro). Thuse the hitsu was the unit of land ownership (and tenancy); the osa was the unit of actual cultivation.

It is difficult to tell from the 1894 maps just how the hitsu parcels were connected to one another in terms of water flow. In Map 12, channel B2 divides at several points and many of the parcels seem to front on a ditch; if so, they may have drawn water directly from the ditch. Some might also have been graded to use the opposite channel for drainage; for example, the 0.7 ha parcel may have had an intake from the channel in its south-east corner and an outlet in its north-west corner into channel A1. But many of the other parcels appear from the map layout to have had to receive and/or discharge water from/to adjacent parcels (takoshi kangai or "parcel to parcel irrigation").

Parcel to parcel flow is a feature common to irrigated rice cultivation in many societies (e.g., Booth 1977:45ff., Spencer 1974), and it is perhaps the technical feature to which the need for coordinated (communal) action is most often attributed. The arrangement is sometimes simplified and schematized as a discrete, nesting hierarchy of main canal--branch canal--tertiary canal--field ditch--parcel block. The Watamae area fields

do not appear to yield to such a neat spatial geometry. Some parcels were directly connected to branch canals, others to tertiary canals, others to field ditches, and still others to no water channel; parcels might drain into a separate branch canal network, into a special drainage canal, or into other parcels. Even parcel size varied widely. Under such conditions, one wonders to what extent it was possible and desirable to generate general formulas and schedules for intake and outlet below the tertiary canal level. The continuous, unplanned elaboration of the parcel construction and ditching that characterized at least the Watamae area may have reduced the coordination possible to a very local scope.

And yet coordination among water users was surely called for. Within what framework did it take place? Was it enjoined and enforced by the domain, whose claims to the land and its produce superceded those of the cultivator? By an irrigation group formed along water delivery lines? By the landlord under whom the cultivator might be a tenant? By the village in which cultivator households (and/or its lands) were located?

It appears unlikely from available evidence that the domain officials, landlords, and network roles exercised much direct authority in coordinating water use at the field level. It is true that, in a broad sense, the paramount position of rice in domain taxation and in the definition of wealth and relative status in the political economy created an irresistable biasetowards expansion of rice acreage; the domain did, of course, retain formal control over paddy field development. But there are no examples of domain directives on the subject of water use--detailing, for example, field construction techniques or ordering certain intake and drainage schedules. The only particular domain constraint on water use was an indirect one: the rigidity of land registration. There were no formal procedures by which the boundaries of land once surveyed and registered could be redesigned. The osa within a single hitsu could be adjusted by the cultivator, but the hitsu boundaries were fixed. No doubt such adjustments were occasionally made unofficially, but the domain controls of land registration locked cultivators into field and ditch patterns that could not be easily altered. As was seen in the Watamae area, with the expansion of arable lands, ditching patterns and thus water flow became more elaborate, but any major efforts to realign and simplify water flow were blocked by the rigid domain controls (on land, not water).

I have found no evidence of landlord direction over tenants' water use. In most cases, it seems that land was let out in simple tenancy rather than sharecropping. Holdings of the large owners were dispersed among a number of villages and households might rent land from several owners in addition to cultivating their own holdings.

Common to both the Nakagawa and Shōryūjigawa networks was an underdevelopment of water user organization at the several levels of canals. Even where effective roles and procedures were to be found, as may have been the case in the Oshikiri Branch Canal service area, this

organization of delivery did not directly constrain in-field water use. Its jurisdiction extended to the tertiary canal level, and it was structured by the participation of village units, however imperfectly these units may have fit sevice area boundaries.

Indeed, it is the extent of village control of households' access to and use of water in their paddy fields that is the crux of water use. As discussed in the first chapter, village controls over water use approaches axiomatic status in the literature of rural Japan, but the paucity of detailed evidence and the investment which many researchers have in finding "community" in the countryside should warn us that it cannot be easily assumed. For the case at hand, given that so little is known as yet about irrigation affairs within basin villages, I can only hazard some tentative observations about the nature of village control.

To be sure, there were ways in which the basin villages (that is, the administrative village coincident with the named and spatially discrete settlement) did manage water at the most local delivery and drainage level and so constrain water use in individual paddy fields. Much of the construction of ditching and paddy fields occurred in domain-approved projects organized by a village but not necessarily involving all households (or even all full-status honbyakushō). Subsequent maintenance of the check basin parcels was the responsibility of cultivators but in many cases, village officers probably coordinated an annual clean-up and dredging of the field ditches prior to spring field preparation.

In some villages there were named and salaried roles for intra-village irrigation matters, but the extent of their authority is unclear. In Kami-oshikiri Village, it was known as uchi-sekimori ("intra-village canal guard"). The 1771 Kakuda-futakuchi Village report listed a shinden sekimori for the new paddy lands across the Ōyama River but no role for the older lands around the village settlement; the salary, only 0.4 koku of rice per year, was 12% of the headman's salary (OB 1974:50-1). On the other hand, Nishi-watamae and Higashi-watamae Village accounts included a contribution to the salaries of the canal watchmen of both Watamae-shinden and Gokamura Branch Canals but mentioned no salary for any intra-village irrigation roles.

Perhaps most important were the tasks of allocation and conflict resolution, particularly during the spring wet tilling and periods of low delivery volumes in the summer months. At such times, how was it decided which parcels could take in how much water when? Where allocation schedules were used at the branch canal level of water delivery, the units in rotation were villages, as for example the rotation cycle along Oshikiri Branch Canal. However, it is remarkable that we have yet to uncover any examples of water allocation or drainage schedules drawn up and administered by these or any other basin villages to distribute water so delivered within their boundaries.

In fact, the effectiveness of village control over such allocation and over management of water use conflicts would appear to have been undermined by two factors. The first was the frequency of land transfers,e especially because parcels often changed hands without respect to village residency. Even where the household composition of villages remained rather constant, the changing fortunes of households resulted in losses and gains in land that disrupted the ideal congruence of residency, cultivation, and ownership. How strong might be "the habit of obedience to community opinion where water was concerned" (Smith 1959:209) in Arayashiki Village, where ten of the forty cultivators of village lands were non-residents, or in Kakuda-futakuchi Village, where over half of the land registered in the village books was cultivated by non-resident households? In such cases where non-resident cultivation was widespread, what force would have remained to "village ostracism" (mura-hachibu), the ultimate sanction of the village as closed corporate community (see Befu 1965e309-11)?

A second factor, as we have just seen, derives from the physical layout of fields and ditches. The apparent piecemeal expansion of the physical network in at least some areas like Watamae created there a literal maze of channeling. The terminal ditching of three different branch canal networks inter-locked elaborately, and even within sections of village fields there was wide variation in field parcel size and flow patterns. It is difficult to imagine how uniform procedures could be applied over the village lands. To the extent, then, that principles and schedules could not be drawn up which were applicable over a large part of a villageés lands, was not village control of allocation thereby weakened? Given the difficulties of village-wide allocation, would not the necessary coordination have been of an even more local and informal nature among adjacent cultivators, perhaps as Vandermeer (1968:729-35) has described for an area of Taiwan?

This lack of evidence of village involvement in water use tasks, the accelerating land transfers in some parts of the basin, and the highly irregular parcel and ditching layouts that may have been found in much of the basin invite speculation that village roles and procedures were increasingly ineffective in irrigation tasks of the water use phase. I am inclined not to accept this speculation pending further research. On the contrary, I find it plausible that under precisely those conditions, village roles and procedures might have proven necessary for at least some taskse Disputes, for example, had still to be resolved, often we might presume between adjacent cultivators of different villages; given a traditional preference for third-party conciliation (Henderson 1965), disputants might have turned to village officers, either irrigation-specific roles such as sekimori or general roles such as headman or village elder.

Moreover, we must remember that in other irrigation contexts the village unit persisted in the face of land transfers and their attendant

disruptions--for example, as the petitioning unit in branch canal and main canal disputes. Indeed, here too, it is very likely that the village unit persisted because of such disruptions. That is to say, a breakdown in the ideal congruence of residency, cultivation, and ownership would have made social order more problematical. Even if such a breakdown would have diluted the effectiveness of such sanctions as village ostracism and denial of work assistance (by which village "solidarity" and "corporateness" is usually held to be manifested), it would at the same time have made it all the more imperative to both peasants and domain officials alike to maintain some framework by which certain tasks might be accomplished. By this reasoning, an increasingly fluid tenure and residence pattern would have only heightened the determination of domain officials to continue the village format as a means of political and economic control. At the same time, the village as a structure of roles and set of procedures would have been maintained by peasants to be activated in certain contexts such as conciliation of disputes among water users at the local field level and presentation of grievances in water delivery matters.

Nonetheless, considering the mutual constraints that operated through the four phases of basin irrigation, even finding areas of strong village control over household water use would not greatly alter the assessment that basin irrigation organization was, overall, decentralized. Even where water use was coordinated by a structure of village roles and procedures, the village and its cultivators were in turn constrained by the physical network, volume, and timing of water delivery and drainage. To note that water use was very much determined by patterns of source control, delivery, and drainage is but to raise an obvious point; however, in this case, where task performance in the other three phases was decentralized, it is also to imply that some areas of strong village control over water use would only represent local exceptions in this fourth phase to the general pattern.

Appendix

This appendix presents five documents relating to inspections by officials of the district deputy's office in 1785-6 concerning allocation along the Nakagawa Main Canal. All are my translations from unpublished source #1.

a. A petition from headmen of eleven downstream villages to their village group headmem.

A Humble Request by Means of this Petition

In recent years, the lower villages have been suffering from a water shortage. It is especially severe this year, and it is thought that the rice transplanting is in serious jeopardy. We brought this problem to the canal guards (sekimori). We were told that the canal banks along the hako-no-uchi section above Matsuo Village are not strong and thus a large volume of water cannot be drawn into the canal through the top water gate [for fear of breaking the canal banks along that section].

We ourselves then assembled and inspected the water flow and allocation conditions along the main canal. We discovered that the channels of all the villages from Mitsubashi Village to the bottom of the main canal [where the petitioners' branch canals began] are drawing more water than in the past. Because the main canal dimensions are fixed by the domain officials [at all points where branch canals diverge], this cannot be the problem. However, it appears as a natural consequence [of annual branch canal cleaning] that the entrances to various branch canals have been deepened to the point where the water level at the end of the main canal is 15.2 cm lower than normal.

Because of these conditions, we very humbly and respectfully request the following: that construction be carried out to raise the canal banks along the hako-no-uchi section and that a survey be conducted by domain officials of the allocation points along the main canal so that sufficient water in quantities equal to past years can reach our canals. We would be extremely grateful if we could receive your attention in these matters.

(seals of) village headmen from Oshikiri Village Group (8 signatories)
headmen of Hirono-shinden Village (2 signatories)
headman of Doguchi Village (1 signatory)

(dated) Tenmei 5, Year of Snake, Fourth Month [23rd Day]

(addressed to) Ōta Kisoji-donod (Naganuma Village Group headman)
Satō Saemon-dono (Yokoyama Village Group headman)

b. Directive sent by Tōzō, a subordinate official in the district deputy's office, to headmen of upstream and midstream villages.

In the fourth month of Tenmei 5, a petition was received from the six villages of Oshikiri, Sanbongi, Fukuoka, Ōfuchi, Doguchi, and Hirono-shinden reporting that the water in the main canal reaching Yokoyama [the terminal point of the main canal] was 15.2 cm below normal level and rice planting was in serious jeopardy. They requested a canal survey because it appeared that the intakes of the branch canals of the upstream villages had been deepened to improve flow into the branch canals but with the consequence that volume reaching downstream villages has been greatly reduced.

On the 24th day of the fourth month, I summoned the main canal guard (ōsekimori), Ōta Kisoji, Satō Yaota, and other [unspecified] village officials and conducted a survey of the canal from above Mitsubashi Village to below Yokoyama Village. As a result, I am ordering the following dimensions [for branch canal intakes]:

1. Aramata-Akagawa Branch Canals' intake: the main canal sekine is to be widened 9.1 cm.
2. Hosoya Branch Canal intake: the main canal sekine is to be widened 24.2 cm.
3. Daihanda Branch Canal intake: the main canal sekine is to be widened 9.1 cm.
4. Watamae-Hirakata Branch Canal intake: (a) using the old measuring pole, a trial makura is to be constructed and (b) to improve the flow to the downstream canals, the main canal sekine is to be widened 45.5 cm.
5. Yokogawa Branch Canal intake: there are no fixed dimensions for this intake, so the spillway is to be widened by 60.6 cm.
6. Tsukegawa Branch Canal intake #1: there are sand bags buried here in the main canal [to raise the water level and increase flow to branch canal]; the top layer is to be removed and the top line levelled.
7. Tsukegawa Branch Canal intake #2: a 45.5 cm wide, squared log is to be placed at the entrance of the branch canal.
8. Wanagawa Branch Canal intake: the 1.5 m squared log is to be removed from the main canal.

In order to deal with the water shortages in the Yokoyama, Oshikiri, and Hirono-shinden areas, I am ordering the above on the basis of my recent investigation.

(seal of) office of Tōzō
(dated) Year of Snake, Fourth Month

[the document continues with the following endorsement on the back]

I agree with each of the above directions, and the work will be done on the day after tomorrow, the 26th. You are ordered to send one person each to the above places along the main canal on that day. This document is to be circulated in order among you and the last to receive it shall return it to this office.

(seal of) Ueno Wakichi
(dated) Fourth Month, 24th Day
(addressed to) headmen of the following villages: Wanagawa, Tsukegawa, Yokogawa, Hirakata, Watamae, Daihanda, Hosoya, Akagawa, Aramata

c. A memorandum, probably written by Tōzō or Ueno Wakichi of the district deputyds office summarizing their actions.

1. On the 23rd day of the fourth month, a petition was received concerning a water shortage in Oshikiri, Hirono-shinden, and Doguchi. On the 24th, an inspection was made of the main canal from above Matsuo Village to below Yokoyama Village. On this inspection round, Ōta Kisoji, Satō Yaota, the main canal guards, and relevant village officers accompanied [the district deputy officials].

2. On that day [the 24th], the conditions of and directions for the main canal sekine from Aramata-Akagawa Branch Canals intake to Wanagawa Branch Canal intake were written down and the document circulated.

3. Concerning the sekine at the Hirakata Branch Canal intake. During the recent construction along the main canal, it was reported by Heisaburo, a representative of the construction foremen, that there were two measuring poles in the main canal in front of the Hirakata Branch canal intake. The old pole was 12.1 cm higher than the new pole. Using the old pole, he had a makura put in, and then adjusted a single measuring pole to half the distance between the old and new poles. Because water was still backing up [in the main canal] in front of the intake, he had the sekine widened by 36.3 cm. Next spring, during the annual canal inspection, this section must be very carefully checked.

4. The other points along the main canal were fixed according to the directives.

5. The drainage canal of Tsuchibashi Village is used by Oshikiri and Hirono-shinden [Branch Canals to supplement water from the main canal]. Custom has not been followed, however, and the canal has not been cleaned and dredged properly. During the spring canal cleaning, it must be carefully dredged and grasses and bushes in the canal must be cut out.

6. On the 26th, the main canal sekine adjustments were made; this was checked on the same day. Because the various canals drawing water from Oshikiri Branch Canal are within the jurisdiction of Ota Kisoji, he was directed to see that water was flowing smoothly into all those canals.

7. Along the section of Hirono-shinden Canal where it passes through Tsushima and Oshikiri Villages, villagers of the latter two have dug small channels and without authorization have been drawing water in from the Hirono-shinden Canal. This must cease, and officers of both villages were summoned and ordered to make sure that all such channels are filled in. Officers and canal watchmen from Hirono-shinden Village were told to check to see that they have in fact been filled in.

(dated) Tenmei 5, Year of Snake, Fourth Month

d. Other entries of uncertain authorship and date which appear to be fragments of 'intra-office' or 'inter-office' memoranda from the district deputy's office.

--It is hereby reported that construction was carried out along the main canal from Aramata-Akagawa Branch Canals [intake] to Wanagawa Branch Canal intake in line with the directive [of the 24th].

--Concerning the matter of Hirono-shinden. Because the cultivators in Tsushima and Oshikiri Villages had dug small channels to take water from Hirono-shinden Canal [as it passes through those villages], officers of both villages were summoned and ordered to see that the channels were filled in; Hirono-shinden officers and canal watchmen were ordered to check. However, the channels were not filled in as ordered, and so because Ōta Kisoji [Oshikiri Village Group headman] handles matters regarding channels in that area, he was summoned and ordered to do what is necessary to insure water flow to Hirono-shinden.

--On the occasion of inspecting Hirono-shinden Branch Canal, it was observed that along the east bank of Tsuchibashi [Drainage] Canal and along both banks of Oshikiri and Hirono-shinden Branch Canals, there were many trees and bushes growing out into the canal [thus obstructing the water flow]; they were ordered removed and the canal banks cut [that is, where the inside of the bank has collapsed].

--Last year (Year of Snake, Fourth Month), there were difficulties in water reaching Lower Oshikiri, Ōfuchi, and Fukuoka Villages; because they heard that this was because villagers in Sanbongi [upstream along the same Oshikiri Branch Canal] were freely taking in water, these villages sent a petition [toe?], on the basis of which Harada Kanazuke made an inspection. Following this, there was a meeting between [or "with"?] Ōta Kisoji and Satō Saemon, which resulted in the following decisions: .....[the passage does not continue]

--There is much growth from both banks of Tsuchibashi Drainage Canal extending into the channel and obstructing the flow; this is to be cut and removed.

e. A memorandum, probably of the district deputy's office, concerning a meeting held with the Oshikiri Village Group headman, Ōta Kisoji.

Last year the main canal was surveyed and construction were conducted between Mitsubashi and Yokoyama Villages to alleviate a water shortage in the Oshikiri Village Group area. At that time, it was heard that Shimo-oshikiri, Ōfuchi, and Fukuoka Villages were having difficulties getting water because cultivators in Sanbongi Village had dug channels and were freely drawing out extra water from the [Oshikiri] Branch Canal. Harada Kanazuke was sent to inspect the conditions in the fourth month of this year [Tenmei 6, 1786], and there was a meeting with the village group headman.

1. There is a considerable growth from both banks of the Tsuchibashi Drainage Canal which extends into the canal and obstructs the flow; this must be cut.
2. The seed bed channel [for irrigating the rice seedling beds] within Yokoyama Village which is no longer being used is to be filled in.
3. Concerning the construction of the intake to the tertiary canal drawing water from Oshikiri Branch Canal to approximately 200 koku of Sanbongi Village paddy lands: the Oshikiri Branch Canal is to be widened by 60.6 cm to 1.82 m at that point.
4. To the east of the intake to the Tsushima Village Canal, cultivators have cut an opening to draw water into a pond they maintain for fire prevention. This is not permitted and must be closed up [the pond is probably fed by a shallow well].
5. Generally, the upstream villages [along Oshikiri Branch Canal] have come to take in water freely [without regarding the needs of the downstream villages]. To prevent this, any new projects and repairs must be preceded by a meeting with the officers of the lower villages.
6. From Oshikiri Village downstream, cultivators have dug small channels from the branch canal and are freely taking in water. However, with each passing year, attention to canal cleaning and repairs grows more lax. We take this occasion to remind cultivators strongly that such cleaning and repair work must be done.

The above was transmitted to Ōta Kisoji at a meeting.

(dated) Year of Horse, Fourth Month [Tenmei 6, 1786]

Chapter VII

INTERPRETATIONS AND IMPLICATIONS

The preceding chapters have presented a description of Aka River basin irrigation, conceived broadly to include water source control, delivery, use in the paddy fields, and drainage. Further, they have offered a characterization and analysis of basin irrigation roles and the distribution of authority among them. Investigators of agrarian regions in Japan and elsewhere have tended to neglect the social patterns of use and management of water resources, focusing instead on the disposition of land and labor. This study was undertaken to illustrate how one might formulate with analytic rigor a longitudinal case study of irrigation organization in a setting where water was both critical to cultivation and problematical to cultivators. It is further based on the premise that understanding the dynamics of irrigation in the Tokugawa countryside is essential to our full appreciation of the political economy of that agrarian state.

The geomorphology of the Aka River basin is a common one in Japan, with a steep, forested headwaters, an arable alluvial fan, and a flat downstream plain (Koide 1975). Like many of the thousands of delivery-drainage networks in Tokugawa Japan, the Aka River networks were gravity-flow, multi-level canals, branching across the plain from separate intakes along the alluvial fan and serving paddy fields in several to many villages (Tamaki & Hatate 1974:240-298). Yet if the drainage basin topography and physical network design were representative, even a cursory glance at other areas of Tokugawa Japan (Kitamura 1973a) reminds us of substantial variation in organizational patterns, an issue that demands future comparative research beyond the more modest goals of the present study. Rather, in this final chapter, it remains to bring together a summary description of Aka River irrigation with an interpretation of why such a decentralized form persisted through the period. Following that I will consider some of the implications of this argument for the political economy of Shōnai Domain and for the broader anthropological study of "irrigation's impact on society" (Downing and Gibson 1974).

Construction. The basic physical facilities of basin irrigation were the levees along the river, the weirs and river intakes to the eleven main canals, the branching earth canals with their spillways, water gates, flumes, and intakes, and the bunded paddy fields themselves. The original

impetus to this technologically simple but intricately interlocking network was the small embankment construction project in the alluvial fan section by the Mogami retainer, Niizeki, in 1605-06. The resulting river stabilization allowed canal and paddy field construction, typically by local initiative and direction with formal domain approval. The digging of the Shōryūjigawa Main Canal, for example, was organized by the household of the headman of a midstream village; like other main canals it was largely a modification of an old river course. In the next fifty years, a total of thirty-seven branch canals were dug; after the 1658 registry that came to define canal network boundaries, there was only elaboration and extension of branch and tertiary canals. How perfunctory was domain approval is problematical. In Shōryūjigawa, there is no evidence that requests to build branch canals were rejected, but then neither is there evidence of such requests being made after 1658. Domain approval was valued because it was a basis on which to seek later financial support for reconstruction and major repairs to the works from the public works fund (e.g., Narita's drainage gates).

Because wood, earth, and straw rope and matting were the principal building materials, reconstruction was periodically required. The distinction between (re)construction and normal maintenance was financial--public works money could often be expected for the former, but not the latter. The largest reconstruction project in the basin was that of the Kumaide intake, done in principle every twelve years. Dimensions, design, and materials were carefully replicated. Although complex, the project was probably not technically demanding; the most crucial managerial skill was requisitioning, recruiting, and directing the necessary labor, a task handled by the two Kumaide ōsekimori. In this way, they were able to manipulate labor needs for personal profit. The rural magistrate's office exercised only a passive oversight. None of the structures along the Nakagawa Main Canal approached the Kumaide intake in scale, though they too were reconstructed with subsidies from public works monies, apparently under the direction of the main canal ōsekimori, with support from peasant-stratum technical assistants in the district deputy's office.

There was little, if any, perceptible technological change in either river works or canal structures throughout the period, despite the expansion of paddy lands and recurrent flooding. Domain officials rejected almost all proposals for improved river training and channel straightening, restricting domain tax monies to repair of damaged levees. The canal networks tended to expand through accretion rather than replacement, the effect of which was to complicate an already complex dendritic pattern with elaborate overlapping (e.g., the channel patterns around Watamae and the water arrangements made for Hirono-shinden).

Operation-maintenance. The strategic importance of the Shōryūjigawa Main Canal in supplying the castle moat led the domain to assign responsibility for maintaining the intake works to the six surrounding

villages (only a minority of whose lands were within the Shōryūjigawa service area). They were exempted from all miscellaneous taxes and corvee in return for providing all needed labor and materials for ordinary maintenance and limited labor duties in the gate reconstruction. Two ōsekimori were appointed and supervised by the rural magistrate's office; the positions were generally hereditary, although one was removed in 1774 in favor of a branch household head after complaints from service area villages about poor performance. At least one of the ōsekimori households had sizeable land holdings in the six-village area by the mid-1880s, but the relation between the position and land accumulation cannot be traced with present evidence.

In 1840, despite domain opposition, the village assemblies of the six villages did revise their delegated maintenance responsibilities to limit the increasing demands on their labor and materials by installing a contractor system. The ōsekimori then asserted some degree of control over the contractors and in 1863 replaced them with themselves in the redefined position of contractor.

These procedures concerned the intake works only. Along the unlined main canal itself, the annual spring dredging was divided among service area villages by a corvee formula, with the main burden falling on the downstream villages. The duties of the Kyōden area ōsekimori were unclear, but I suspect that they supervised the dredging, inspected the canal banks regularly for breaks, slides and channel growth, and organized bank repairs. They probably reported to the Kyōden Village Group headman, but they could not initiate any requests to the domain. Channel bank repairs appear to have qualified for some public works monies.

The principal works along the main canal, the intakes to the branch canals, were generally maintained and operated by the branch canals--that is, by a canal guard (sekimori) appointed and supervised by officers of villages in the branch canal service area or, in the event of a long branch canal, by a special gate guard serving under the sekimori. The intakes themselves were simple structures, although some of the water-raising and drainage gates along the canal were sizeable enough to receive public works support for repairs.

Along the Nakagawa Main Canal, ordinary maintenance was handled by two Main Canal Guards (ōsekimori), hereditary positions held by households, one at the top of the canal and the other at the tail-end. There were also gate guards responsible for maintaining and operating the main canal intake gates and the spillways under ōsekimori supervision. Matters concerning the river intake and the top two kilometers of the main canal were contracted to Mawatari Village in a much simpler and less costly arrangement than that with the Kumaide six villages. The ōsekimori oversaw Mawatari's performance and also organized the annual main canal dredging. Generally, though, the ōsekimori position was limited both in rights and duties. They appear, for example, to have had little authority

over branch canal intakes--and thus, allocation. There is no example of an ōsekimori petition or report to domain officials, and they may best be characterized as a specialized irrigation role intermediate between village headmen and village group headmen.

As in the Shōryūjigawa area, there were no formal irrigation organizations on either the main canal or branch canal levels. There were for most branch canals one or two water guards, appointed and overseen by the village assemblies or officers of service area villages. Main canal and branch canal expenses were assessed to all villages in proportion to registered yield; an analysis of several village accounts suggested that total irrigation expense burdens were light. Even in 1845 in Higashi-watamae, irrigation expenses represented only 5.5% of all village taxes and 3.3% of its total registered yield.

Allocation. Intake volume from the Aka River to the main canals was determined by the positioning of the weirs and by the "customary" dimensions of the intake gates. The maximum opening of the Shōryūjigawa gate, for example, was fixed at 7.88 m wide and 1.06 m high (that is, 8.35 square meters).

The 1658 registry defined in effect the official service area of the Shōryūjigawa Main Canal to the extent that it enumerated those branch canals and, within the branch canals, those villages entitled to its "irrigation water" (yōsui) and responsible for its maintenance. However useful in bounding the service area, the registry did little to define relations among these villages and branch canals with yōsui rights. Paddy land acreage yields were listed for each village and branch canal, but these figures soon came to vary widely with actual conditions. Branch canal intake dimensions were not specified, and the register contained no statement of the principle by which main canal yōsui water was to be allocated among the branch canals.

Later documents indicate there were two allocation states along the main canale normal allocation of a continuous flow to open branch canal intakes of fixed dimensions and three types of special allocation. Thee extant examples of special allocation were all instituted by village group headmen or rural magistrates upon petitioning by village units.

Although on several occasions there were adjustments of branch canal intakes by order and under the direction of rural magistrate officials and village group headmen, they generally affected only those branch canals immediately involved in a dispute and were inconsistent and ad hoc. The first evidence of measureable, consistent written standards was not until 1824. By these, the main canal width was fixed at the point of intake and the minimum height of water flow in the main canal below the intake was specified. Even so, these were normal allocation state standards, not special state standards, and there was no unambiguous statement of the allocation principle used to establish these dimensions. This remained true for the entire period.

Complicating allocation of Shōryūjigawa water was the issue of morai-mizu. These morai-mizu agreements were typically between midstream or downstream service area villages and new paddy lands on the west bank of the Ōyama River. Disagreements arose among main canal irrigators about whether the granting of morai-mizu rights was a perogative of a village or a single branch canal and whether other branch canals might veto such negotiations. In all cases, it was an issue in which domain officials were reluctant to intervene, as demonstrated by the example of Hayashizaki Branch Canal and the new paddy lands across the Ōyama River. Extension of such rights generally brought trouble, as the recipients came to expect a regular share of branch canal water and to attempt to convert morai-mizu to yōsui rights, e.g., by obtaining domain support for gate and flume construction.

For the Nakagawa Main Canal service area, there was no listing equivalent to the 1658 registry of Shōryūjigawa that formally defined the service area boundaries, branch canals, and villages. However, the master stream to the west and the Hirose-Fujishima River to the east effectively limited the reach of the Nakagawa Main Canal; because the Fujishima River was wider than the Ōyama River and because the opposite bank lands were irrigated by the Inaba Main Canal, there were none of the pressures for extension of morai-mizu rights like those posed by the Ōyama left bank villages.

As with Shōryūjigawa, there was no clear statement of the principles by which main canal or branch canal water was allocated, but in the 1785 and 1797 inspections and adjustments by the district deputy official Ueno Wakichi, a proportional allocation norm was enunciated--proportional, that is, to village paddy land registered yields. This was also cited when Ueno intervened in the Watamae area tertiary laterals dispute in 1805, and there is further evidence of its application in the Inaba service area in 1797, when Ueno and the village group headmen inspected deteriorating branch canal intakes along the Inaba Main Canal and adjusted dimensions in accordance with the previous year's registered yields.[85] It is problematical, of course, how often the principle was cited in years before and after Ueno's term in the district deputy's office, though I believe it fair to suppose that allocation proportional to registered yield represented what water users might commonly expect when petitioning domain authorities (if in fact hearing was granted the petitions).

The existence of such a principle was one matter; its application to actual situations presented further difficulties. We have seen that by 1785, there was a variety of structures by which Nakagawa Main Canal water was taken in by the branch canals. How this variation originated is not clear but as with Shōryūjigawa branch canals, these intake structures had

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[85] The precise wording in the Inaba document was kyonenchū takawari o motte bunsui aitachi sōrō (Naganuma 1978:56).

the force of precedent. It was apparently difficult for Ueno and the village group headmen to design concrete measures to effect proportionale allocation. If a sekine existed at an intake, its dimensions might be adjusted, but if none existed, they seem to have lacked the authority to order its construction. At the branch canal level, Ueno did order changes in the division point between Hirono-shinden and Oshikiri Branch Canals and in the tertiary lateral divisions in the Watamae area, but even in these cases, we must remain skeptical of whether consensus was reached about what concrete measures constituted fair application of proportional allocation.

There is no extant evidence of rotational allocation among the branch canals as was organized on at least two occasions--and probably more--along the Shōryūjigawa Main Canal. There were rotational allocation schedules for the summer low water months along at least some of the branch canals and tertiary laterals. There are brief, occasional references to roles in some villages which may have had duties connected to intra-village water allocation among parcels, but curiously no examples of allocation and drainage schedules within basin villages have been discovered.

Conflict resolution. Irrigation conflicts arise over issues of all of the above tasks--construction, operation-maintenance, and allocation. Their resolution may be handled by irrigation-specific roles or groups such as water judges and water courts, but this was not the case in the Aka River basin. As with other tasks, there was a formal articulation to domain administrative roles, but a predisposition to handle conflicts at the lowest possible level. This was more conducive to endemic quarreling than quick resolution and undermined potential collaboration and coordination. For example, a majore obstacle to river control and drainage improvements in the lower basin was continued friction among the injured parties themselves, such as the long-standing dispute between Narita-shinden and Obana Villages.

Elsewhere in Shōryūjigawa, there were at least occasional disagreements between the service area villages and the intake ōsekimori over procedures at the intake works; the ōsekimori were accused in petitions to domain officials of laxity in protecting the works against high water and poor maintenance of the works in times of low water. The ōsekimori found themselves in the middle of another dispute between domain officials and the six villages over rising maintenance costs, with the latter eventually initiating a new contractor system in 1840.

Along the main canal, it was shown that the familiar upstream-downstream disputes occurred here in the context of a tripartite, up-middle-down division of branch canals. The small upstream branch canals seldom appear in extant cases, most of which refer to disputes between the midstream canals and the tail-end four. The majority of cases date from 1750-1820 in the form of petitions from various combinations of

villages from the tail-end four branch canals complaining of water shortages and consequent crop losses. While a range of reasons were cited--the condition of the river, water guard negligence, poor main canal maintenance, and excess intake by midstream branch canals, it was the last that was most consistently advanced. These multi-village petitions were typically passed through the Kyōden Village Group headman and/or the Ōyama shogunate office to the domain rural magistrate's office. After discussion within the office and/or between officials and village group headmen, the matter was dropped, some action was taken by the officials, or it was referred back to the village group headman for conciliation or action. The three inspections and adjustments of the midstream and tail-end branch canal intakes in 1723, 1794, and 1824 were examples of joint official-village group headman action. A more frequent resolution was a one-time special allocation of tōshi-mizu to the tail-end canals, organized by the Kyōden Village Group headman and probably actually done by the Kyōden ōsekimori.

In assessing the claims of villages in the tail-end branch canal area, it was concluded that while it is reasonable to assume there were in fact shortages, whether midstream branch canals willfully violated intake procedures is much more problematical. Appeal to a respect for "custom" was a common petitioning device, but there do not seem to have been any unambiguous standards or guides to main canal allocation before 1824. There was paddy land expansion in both the middle and lower service areas which increased demand universally though not uniformly. One can appreciate the wariness with which domain officials approached the problem. They vacillated not only because the past was an uncertain guide but also because the future was unpredictable; adjusting for expanding acreage would leave them open to future claims. There was also a certain delicacy to the petitioners' claims because there was much leniently surveyed and some unsurveyed land for which they were now claiming shortages.

Branch canal level conflicts also typically revolved around (a) alleged or actual disruption of water flow to downstream villages by those more upstream along a branch canal and (b) the use of excess and drainage water outside of a branch canal service area. Upstream disruptions of flow included simply cutting off the canal water flow (e.g., Naka-kyōden and Futakuchi), digging extra offtakes from the branch canal (e.g., Inoko and Narita-shinden), and operating gates along the canal to upstream advantage (e.g., Kakuda-shinden and Nishi-nonuma). Problems of Futakuchi, Zennami, and Higashi-nonuma with Nishi-nonuma and those between Hayashizaki Branch Canal villages and Yonede-shinden were illustrative of the difficulties arising from use of branch canal water by Ōyama left bank areas.

In these disputes, usually one or more villages made allegations against one or more other villages in a peition to the domain through the village group headman. Occasionally, district-level officials intervened to arrange a settlement, but more typically, the village group headman,

upon receipt of the petition, delegated conciliation responsibility to headmen of neighboring villages.

In the various conflict cases that were discussed for the Nakagawa service area, there were two recurring complaints. First, there were allegations brought by villages in the Oshikiri and Hirono areas of shortages during spring transplanting and the summer dry period due to midstream branch canals' altering their intakes (by deep dredging, for example) to let in "too much" water. Another frequent complaint by irrigators in all branch canals along the Nakagawa Main Canal below the Tenkō Intake was poor maintenance and structural weakness in the hako-no-uchi section of the main canal, which limited the flow volume below what was necessary for spring tilling and transplanting.

As with Shōryūjigawa, evidence of dissatisfaction began in the mid-1700s. The 1785 petition by Hirono and Oshikiri area villages voiced both these complaints. Ueno's response, to inspect the main canal with the village group headmen and to order adjustments of some of the branch canal intakes, brought no lasting relief. His criticisms of the petitioners themselves, the poor maintenance of their branch canals and the disruptions of Hirono flow by Oshikiri cultivators, amounted only to admonishment and exhortation.

No action was taken about the hako-no-uchi section, which was the subject of complaints again in 1797 by most of the branch canals. The midstream branch canals wanted permission to move their intake locations upstream of the hako-no-uchi section, but this was opposed by villages whose lands would be used for channels and it was turned down by Ueno. There was some shoring up of the canal banks and another adjustment of intakes. The weir-like makuras in the main canal below the branch canal intakes were lowered to increase the water velocity and thus the volume in the main canal, but there were no fundamental improvements in the hako-no-uchi section itself. It remained a source of friction and complaint throughout the period.

Problems along the main canal had repercussions on the branch canal levels, as for instance the frequent conflicts between Oshikiri and Hirono-shinden Branch Canals. The situation was reminiscent of Aoyama Branch Canal and the Narita-shinden Tertiary Lateral.d Hirono-shinden Branch Canal, running through the villages in the Oshikiri service area, was vulnerable to all manner of use and abuse by Oshikiri residents. Its complaints brought occasional intervention by domain officials, usually directing the two village group headmen (Yokoyama and Oshikiri) to see that Oshikiri area residents cease and desist such behavior, but there are no records of punishments meted out. The one constructive action was the stone lining and definition of intake procedures at the place where the two branch canals began.

Main canal conditions also exacerbated relations along a single branch canal, as illustrated by the problems in Watamae in 1806 and the case of Taroemon along Oshikiri Branch Canal in 1850. Here, too, was demonstrated the shifting pattern of cooperation and conflict. Villages along Oshikiri Branch Canal, for example, were simultaneously absorbed in an upstream-downstream conflict amongst themselves, shared common abuses against Hirono-shinden Branch Canal, and joined together with Hirono area villages to protest intake 'violations' of midstream branch canals.

In sum, the conflict resolution pathway for both main canal and branch canal matters was the familiar domain administrative hierarchy: complaint--(water guard)e-village headman--village group headman--domain office (either district deputy or rural magistrate). Those disputes that reached the district officials in the form of petitions were those not able to be settled at lower levels, although this was no assurance that the petitions would be entertained. Even when they were, there were few permanent solutionse As with the performance of other irrigation tasks, the domain officials' attitude was passive and reflexive and intervention was reluctant.

Indeed, such a circumscribed posture was so pervasive and persisting that I have argued that it described the overall configuration of basin irrigation roles throughout the Tokugawa centuries. I have been unable to find any patterned concentrations of active authority in irrigation tasks that might be identified as local autonomy or elite control. There emerged no strong organization of water users nor did either the domain official or large landholder elite assume key roles through which they consistently exercised decisive control.e This is not to say, it bears emphasizing, that the basin was in a state of 'water anarchy.' Water was delivered from river to paddy fields, albeit without much efficiency or equity. Conflicts were endemic in the physical design and social procedures but not epidemic; the same features that bred conflict tended to keep it from becoming debilitating. And, as repeatedly demonstrated, peasant cultivators, domain officials, and (to a lesser degree) large landholders all assumed roles in the management of basin irrigation. But what is analytically important is that none of the three categories of persons came to exercise a decisive and effective authority over the others in all or any of the four phases of Aka River irrigation.

Why was there such a clear pattern of dispersed authority, of decentralized irrigation organization in the basin, especially in the late eighteenth and nineteenth centuries? By the mid-1700s, thousands of hectares of basin paddy lands were served by a ramified, inter-locking network of river and canals; the river water supply was variable and unpredictable and proving inadequate to satisfy demand in critical months of the growing season; and the limited technology of delivery and drainage resulted in a low water efficiency (e.g., leakages) and localized breakdowns (e.g.ę collapse of unlined canal banks). There were, moreover, several potential lines of authority around which irrigation roles might

have been effectively centralized: the formal hierarchy of domain administration, land tenure relations of landlord and tenant, upstream and downstream areas, or the authority inherent in the specialized knowledge and often hereditary recruitment of canal guards. In light of dislocations and shortages of such a critical resource, why did none of these become the basis of a centralized irrigation? The reasons, I would suggest, lay in the changes in the domain political economy that were sketched out in chapter two: the particular forms of land promotion and expansion, of commercialization of rice cultivation, and of large land holdings that emerged in the basin by the mid-1700s. These developments worked in various ways to inhibit and disincline officials, cultivators, and large landholders from moving towards effective, centralized control of irrigation tasks.

There were, to begin with domain recalcitrance, real limits to what middle-level domain officials could do and might want to do beyond the temporary and reflexive measures they characteristically adopted. One suspects that more active intervention in the form of investments in physical network improvements and/or direct and vigilant enforcement of directives would have found little support from higher officials, for several reasonse

First, by the late 1700s, the basic branching canal networks had elaborated through accretion to a degree where it was difficult, if not impossible, to make fundamental changes at one point without reverberations elsewhere. In the Nakagawa network, for example, a drastic solution to Oshikiri area residents' disruptions of Hirono Branch Canal flow would have required increasing the flow in the Oshikiri Branch Canal. To do this without adversely affecting other branch canals would have necessitated costly structural changes to the hako-no-uchi section of the main canal; this in turn would not only have committed the domain to future support of the hako-no-uchi section with public works funds but might also have opened up requests for reallocation of Aka River water for a widened Nakagawa Main Canal.[86]

A lack of financial incentive was probably a second reason why officials were ill-disposed to use domain resources and personnel to fundamentally address irrigation problems. Water shortages and poor drainage most severely affected the newer downstream areas, where under-registration (and thus under-taxation) of paddy lands was widespread. We have seen that by 1860, the domain tax base (that is, the taxable, registered paddy land yields) in the Nakagawa service area was a mere one-third of estimated actual productivity. With mounting domain

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[86] Simply the complexity of each local problem could defy understanding and discourage intervention; a water flow dispute, as we have seen, often also involved matters of yachi use, grass cutting rights, and/or embankment maintenance, to name only irrigation-related issuese

fiscal insolvency and without the draconian measure of another cadastre, there would have been little to gain to the domain in major improvements that would benefit these lands.[87]

Finally, there was what one might call the administrative ethos of the domain. There were precedents for cautious, limited action but not for bold initiatives. There was a disposition towards 'cellular administration,é in which theehorizontal status strata were segmented into local groups, "containers" (Hall 1974), to which self-regulating responsibility was delegated. Petitions and complaints were taken up not from a commitment to adjudicating grievances but from a concern for the maintenance of order. Village group headmen, rural magistrates, and district deputies looked up, not down, taking care that there were no disruptions for which they might be held responsible that would draw the attention of superiors. A first order tactic was to minimize oneés scope of responsibility; only when conflicts and problems did not 'go away' and threatened to draw wider attention were they addressed.

A conceivable organizational alternative to the domain administrative hierarchy could have been extensive self-regulation by peasant cultivators, for example, forming network cooperatives. In at least some other basins of similar geomorphology, there was a fairly high level of water-user organization; the Takahashi River basin in present-day Okayama was one such examplee(Fujii & Kahara 1976). But we have seen that in neither the Shōryūjigawa nor the Nakagawa networks (nor Inaba: Naganuma 1978) was there any evidence of formal irrigation organization at the branch canal, main canal, or river levels--no Jūnikagō, no Nikaryō (Waters 1981), no Balinese "wet villages" (Geertz 1973), no Valencian "irrigation communities" (Glick 1970).

It is easy to imagine lines around which substantial, autonomous organization might have developed. On the river level in matters of source control and drainage, there were potential lines of conflict between lower basin irrigators and alluvial fan irrigators over high water discharges and drainage and between Shōryūjigawa Main Canal irrigators and downstream main canal irrigators over low water river allocation. Within the main canals, we have identified other lines of identical and competing interests. But there were in fact no such broad coalescences of any duration and impact.

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[87] The pressures against a new cadastre were outlined in chapter two, including the domain's dependence on vital transfusions of loans and forced contributions by town mechants, many of whom had land holdings. A further deterrent to sponsoring major physical improvements may have been the public works procedures themselves, by which initial support would have incurred long-term commitmentsefor future upkeep.

To be sure, there was water user participation in irrigation tasks in all phases, as illustrated by the sekimori roles at the main canal and branch canal levels. And the administrative village, the domain-designated local grouping of peasant cultivators, remained the primary unit in many irrigation contexts, as the petitioning party in disputes and as a first-order unit in the allocation of branch canal water and of irrigation-related expenses and labor duties. But equally conspicuous was the absence of supra-village mobilization of peasant cultivators, along either administrative or hydrological lines.

Certainly, by the late 1700s, such efforts must have been frustrated by the accretive, piecemeal elaboration of canal networks and by the shifting, situational pattern of common and conflicting interests at the several levels of each network. But it must then be explained why these conditions came to operate as obstacles rather than as stimuli to greater water user organization. Here, frankly, my interpretation is at its most speculative. I would suggest, though, that despite the persistence of the administrative village in certain irrigation contexts (e.g., in presenting petitions, in organizing maintenance at the most local level), it proved an increasingly inadequate framework in wider associations because continual land transfers had disrupted the ideal congruence of ownership, cultivation, and residence intended by the early cadastres. Compounding this, though I have as yet no evidence, may have been an active domain discouragement of supra-village associations perceived as threats to the domain political order. Could the dissonance between administrative and hydrological boundaries, for example, have been deliberate? There were apparently several redrawings of village group boundaries in the Nakagawa area with paddy land expansion, but except for the small Oshikiri Village Group, there was no closer coincidence of administrative and hydrological lines at the end of the period than at the beginning. It might appear curious to propose that the domain was preventing water user organization at the same time as domain officials were themselves avoiding active intervention in irrigation tasks. But domain economic and political interests need not have been complementary; whatever improvements in water delivery a user organization might have achieved, it might also have been perceived as a threat to domain political order.

Even if it became more difficult for water users to form broad associations by the 1800s, one might wonder if, alternatively and individually, some of the large landholders such as the Kamo merchant Akino or the wealthy peasants like Tōzō in Futakuchi and Abe in Sanbongi, did not come to exert considerable influence in irrigation matters. Did they not, for example, become major forces behind both conflict and conciliation--influencing the outcome of conflicts in favor of their private interests or providing a conciliation alternative to the reluctant officials? The evidence is largely negative, even for Akino, whose holdings were the largest in the basin and were concentrated along the west bank of the Oyama. The single exception was Tōzō, who was both one of the smallest 'large landholders' and headman of Futakuchi; Futakuchi's

continual difficulties suggest his influence to have been somewhat limited.

Still, the possibility cannot be dismissed. To be sure, the lack of improvements to the physical network and of changes in construction, operation-maintenance, and allocation procedures imply that even if these large holders had supported or attempted major irrigation changes, they were unsuccessful. But in conflict resolution, even if they were influential (or perhaps, because they were influential), one would not expect the formal petitions and directives to evince their private and behind-the-scenes roles. Because such formal documents are all that are left to us, the extent of such private influence remains incalculable, at least directly. On the other hand, there are several circumstantial but compelling reasons which militate against expecting a decisive role for these large landholders in irrigation affairs. The first was the dispersion of their holdings among a number of different branch canal and main canal service areas. We have seen that Abe by the end of the eighteenth century held paddy lands in all seven villages along Oshikiri Branch Canal, in Hirono-shinden, and in villages of five other, upstream branch canals in the Nakagawa Main Canal network; at the same time he also had lands in four villages of Aoyama Branch Canal (tail-end of Shōryūjigawa Main Canal), in villages in the Inaba Main Canal service area, and in villages on the west bank of the Ōyama River. Thus, the water interests of his various holdings were more competitive than complementary at the several levels of the networks.

Furthermore, these large landholders generally enjoyed highly favorable land tenure conditions. Holdings accumulated by Akino, Tōzō, and Abe were all concentrated in the downstream plain section of the Aka River basin; they were the first to feel water shortages, they suffered river flood damage, and they had serious drainage problems in the fall which kept the soils water-logged through the winter and had deleterious effects on plant growth. These same lands, however, were greatly undertaxed; Abe received a total of 1000 koku in rent rice from his tenanted lands in 1797, of which only 15% (150 koku) was due as domain taxes. It is not unreasonable to expect Abe and other large landholders to have balanced involvement in irrigation matters in a way decisive enough and on a scale extensive enough to effect significant improvements in their water situation against possible costs of such intervention--not only the costs of physical system improvements but also possible adverse changes in land tenure and taxation. This is especially true when one considers how tenuous and uncertain were the prospects of improving one's water rights and when one remembers that the best they might expect from formal domain action was a share of water proportional to registered yield--hardly worth agitation under the circumstances. For these and perhaps other reasons,[88] then, the

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[88] Both Satō in his work on Tōzō holdings (1965) and Igawa in his work on Honma holdings (1967) assert that in the late domain period, it was

large landholders tolerated water problems and were unwilling to become more actively involved in irrigation affairs.

Continued research on Shōnai Domain is necessary to further test what remains a somewhat speculative interpretation of basin irrigation. Modifications are inevitable, but I believe the general lines of the argument will hold. Certain aspects of the basin environment and the domain political economy appear to have initially favored some form of centralized water management. Instead, however, the ecological and political features of paddy land development in the 1600s and its economic and social consequences in the 1700s led to a persisting stand-off between domain officials, large landholders, and peasant cultivators in irrigation affairs. The result was the shared, decentralized management form this study has detailed.

Implications.

Irrigation was the disposition of a most critical--sometimes the most critical--resource in the Tokugawa countryside. I observed at the outset of this study that water control and use has usually been investigated within single villages but that this overlooks the fact that irrigation more broadly conceived was generally a supra-village level of organization. The configurations of roles that operated most of the thousands of irrigation networks were regional in scale, intermediate between village and domain. Herein lies irrigation's significance to our understanding of the dynamics of the Tokugawa agrarian state. The ways in which peasant cultivators and state and non-state elite interacted in irrigation tasks should tell us much about the distribution of authority, wealth, and status through the countryside.

We now have some sophisticated, general models of the Tokugawa state and economy, most notably, in English, in the work of Hall, Crawcour, Yamamura, and Hanley. We also have excellent analyses of relations among the state elite (e.g., Bolitho 1974, Totman 1967), detailed studies of formal and informal judicial processes (Henderson 1965, 1975), institutional studies of several domains (e.g., a number of papers in Hall and Jansen 1968), and an increasing number of village and household studies. What we know less about are the actual connections between the elite and peasants and the activities of and relations among peasants at

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very difficult for the landholder to alter the terms of the tenancy agreement and increase the rent due from the tenant. They do not offer evidence of this assertion, but if it was generally the case in the basin, it would have been another factor discouraging landholder intervention in irrigation affairs; they could not personally profit from improvements in yield stability and productivity that the downstream areas might gain from reform of physical facilities and procedures.

the supra-village level--in short, about the structure of local regions.[89] How was political authority exercised at this level? How were rice-growing regions organized? In what ways and to what extent was the countryside integrated, both vertically and horizontally, politically and economically?

This investigation of Aka River irrigation suggests a rather loose political integration of the basin. As frequently remarked, the exercise of domain authority in basin irrigation was passive and circumspect. Large landholders, too, remained for the most part uninvolved, and control of irrigation never became an issue of contention between them and irrigation officials. Nor did peasant cultivators organize into supra-village associations. In sum, vertically there was less elite coercion than one might expect from an area controlled by a single domain, and, horizontally, there was less peasant cooperation than one might expect from the topography and physical network layout. It appears that the more the domain political economy changed, the more Aka River irrigation remained the same. This organizational and technological stasis is also remarkable in light of the generally rising productivity of the Tokugawa rural economy (Hanley and Yamamura 1977). Was Shōnai an exceptional area? Was water control, even in this rice region, not as important to political authority or agricultural productivity as one might expect? These questions demand both comparative study of other river basins and more comprehensive research on Shōnai Domain political economy. Only then can we fully explain the economic and political importance of basin irrigation.[90]

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[89] Exceptions in English include the fine study by Hauser (1974) on Osaka area cotton growing and marketing and the recent work of Waters (1981).

[90] This study suggests another contribution that a 'local region' perspective can offer. Hanley and Yamamura (1977), expanding on the work of Hayami, have proposed that the rural economy was steadily improving through the Tokugawa centuries and that with a decline in population growth rate in the eighteenth and nineteenth centuries, there was a general rise in the rural per capita standard of living in this second half. Smith (1977), working on the village level, has emphasized that within this generally rising curve there was constant fluctuation in the fortunes of individual households, indicative of the intense competitiveness of household unit farming and resulting in continual land transfers as households attempted to maintain a precarious balance between household labor and land.

This proposition about the competitiveness of Tokugawa farming can be pushed even farther if considered in a wider, supra-village context. We have seen how in the Aka River basin the domain, indits promotion of paddy land expansion into the lower basin, created sizeable differences in relative tax burdens within and across villages. We have seen, too,

However this issue is resolved, the study has already made clear the converse--the importance of local political and economic structures in shaping the forms of irrigation organization. As such, it stands as a useful corrective to an unfortunate style of explanation in much of the social science literature on irrigation. This is the tendency to posit certain hydrological conditions or a certain 'scale' of physical facilities as operating directly and mechanically to determine the form of irrigation organization. This owes much to the tone of Wittfogel's hypothesis; his postulated developmental sequence leading to a general state despotism by hydrobureaucrats was triggered by the water scarcity and control difficulties of certain arid and semi-arid environments. In similar fashion, the conclusions of Maass and Anderson's study (1978) of six irrigated areas in Spain and the United States rest on the rather direct line of reasoning that the unpredictability of water flow creates psychological insecurity and social conflict (or at least the threat of conflict) among those who would use it; for successful irrigation, water users must overcome this insecurity and insure predictability by working cooperatively to form and maintain a strong collective water user organization:

> Why is water so conducive to this conflict? Principally because it flows, its unregulated flows are likely to be erratic, and in arid country the consequences for any user unable to capture water the moment it is needed are likely to be dire. The location of a farmer's headgate on a water distribution channel very largely determines his social relationships with members of the irrigation community, as well as those outside the community who use the same water source; and these relationships are potentially disruptive. Also, the unpredictable character of stream flow can create a tense environment of uncertainty that is disruptive of social relations. In more formal language, certain features of the technological or production function of water use such as the flow and stochasticity give rise to social conflict and to the objective of controlling it. (Maass & Anderson 1978:2; see also pp. 9-10, 366, 399-400)

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how land transfer patterns and land holding concentrations followed upon this differential attractiveness of land. Although mean yields in these newer paddy lands improved over time, they remained unstable because of water and soil conditions; small holders were left vulnerable to wide harvest fluctuations. But because of their minimal tax burdens, these parcels came to form the basis of large holdings. Poverty and prosperity were differentially experienced among households and by households over time. Fluctuation may have been, as Smith (1977) and others argue, a function of the balance of household labor and land, but this calculus must also include variations through the basin in the valuation of paddy land.

Leach, perhaps characteristically overstating his case in introducing his study of the Sri Lanka village, Pul Eliya, alludes to the primacy of "topography":

> But the Pul Eliya community does not only operate within an established framework of legal rules, it also exists within a particular man-made ecological environment. It is the inflexibility of topography--of water and land and climate--which most of all determines what people shall do. The interpretation of ideal legal rules is at all times limited by such crude nursery facts as that water evaporates and flows downhill. It is in this sense that I want to insist that the student of social structure must never forget that the constraints of economics are prior to the constraints of morality and law. (1961:9)

Netting adds another variable as an alternative stimulus to centralized irrigation organization, the scale of physical facilities:

> Hierarchical authority may be a necessity only when (a) the scope of irrigation works requires for its construction and maintenance greater capital investment or technological skill than can be provided by individual cultivators or local associations, or (b) when a growing scarcity of water threatens disorder and conflict which will seriously reduce the utility of the system. (1974:33)

Spooner (1974), in a comparison of two Iranian oases, concludes that centralization in irrigation organization results from physical system complexity; Bennett (1976:399) and Lees (1973) in rather different formulations imply an essentially similar proposition.

Such proposals as these do not go unchallenged in the literature; there is much debate, for instance, on the proper meaning and explanatory power of physical facility scale (see Millon 1963, Adams 1966, Pasternak 1972:194, Kappel 1974). But they do illustrate the tendency to construct explanations from 'pured hydrological and engineering variables. In questioning the causal primacy of such facts of water and engineering in determining forms of irrigation orgainzation, I do not deny the play of natural forces on human behavior. I would not turn Leach on his head and claim, for example, that land tenure is more determinative than rainfall. The error in this style of explanation that begins with the scarcity, flow, and unpredictabilty of water or the scale of hydraulic engineering is more insidious; it lies in its implicit but false opposition of nature and culture. 'Scarcity,d 'stochasticity,' and 'scale' are not variables that operate directly and uniformly on water users. They do not by themselves pose "organizational requirements of irrigation" (Netting op. cit.). They are not prime movers, cannot themselves explain anything, as Cowgill (1975) has cogently demonstrated for population pressure, often

elevated to a similar explanatory status. Rather, these natural conditions and physical features motivate human action and association only in terms of the historical moment at which they are experienced, the cultural presuppositions by which they are experienced, and the social position of those who experience them.

It is undeniable that precipitation patternsein the Aka River basin were 'uncertain,' and that water in the basin exhibited a marked (and to those at the tail-end, distressing) tendency to flow downhill. By the mid-1700s, acreage expansion had pushed demand rather tightly against the available supply, and there is clear evidence of uneven distribution and considerable in-transit losses. The records of complaints and allegations that began in the second half of the eighteenth century demonstrate that some, at least, found the situation inequitable and intolerable. Yet these 'shortages' and 'dislocations' were experienced in terms of the domain political economy.

Let us assume, hypothetically but not unreasonably, that there was a 0.5 hectare paddy land parcel in the upstream village of Minde that was receiving 0.0008 cubic meters of water per second, a 0.5 hectare parcel in the downstream plain village of Futakuchi that was receiving 0.0004 cubic meters per second, and a 0.5 hectare parcel in the Õyama west-bank village of Nishi-nonuma that was receiving 0.0002 cubic meters per second. The conclusion that the Futakuchi and Nishi-nonuma parcels were suffering from 'shortages' of water (or even that they were receiving one-half and one-quarter of the water volume of the Minde parcel) does not follow directly upon these figures. It would depend, first, to the analyst as well as to the cultivators and officials, on agronomic and agricultural considerations--soil types, water permeation rate, and the often variable watering strategies of cultivators. It would also depend on a political-economic evaluation of water needs and paddy land rights. As land which was (1) registered as (2) paddy land in (3) an administrative village that was within (4) the official service area of a branch canal which had a formally acknowledged intake along (5) a main canal, both the Minde and Kakuda parcels would be entitled to yōsui, "irrigation water," Aka River water delivered through that canal network; water from the parcels could also be drained back into the canal network. In contrast, the Nishi-nonuma might only expect morai-mizu, "received water," the surplus or drainage water received through private negotiations with yōsui units for paddy lands which were either unregistered and within a service area or else, as Nishi-nonuma, outside the service area. The Nishi-nonuma cultivator might still feel a 'shortage,' but only through his presuppositions about water needs, watering strategies, and paddy land rights.

It is no easier to judge relative volumes between the Minde and Kakuda parcels because we have seen that a right to Shōryūjigawa "irrigation water" and actual water distribution principles within the network were separate issues. There were two standards of allocation, by customary

intake dimensions and in proportion to registered yield. Both could be interpreted as 'equitable,' but neither yielded an unambiguous judgment about a 'shortage' in the Kakuda parcel.

Thus, water was certainly scarce and unpredictable in the Aka River basin, but these environmental conditions were experienced in political and economic terms and were interpreted differentially by various actors--only as such were they the basis of social action. It was for political and economic reasons that throughout the Tokugawa period, neither water shortages nor frequent stretches of drought nor the low efficiency of the physical network resulted in active elite intervention or water user cooperation. It was only after 1870, when the basis of land taxation was substantially revised, when legislation was passed by the new Meiji state, and when the structure of the rice market was significantly altered that there was agitation by downstream landholders and mobilization into effective irrigation cooperatives. The same difficult water conditions, the same weak river levees, the same leaking canals were now seen in very different terms.[91]

Thus we learn once again that the constraints of nature are just that: broad constraints, a range of tolerance, within which specific instances of social organization are given form by the matrix of culture. As there are no territorial imperatives, so there are no hydrological imperatives. We can only explain irrigation organization as a social response to culturally defined water resource needs and characteristics. This is the premise on which this study rests and the lesson it seeks to demonstrate.

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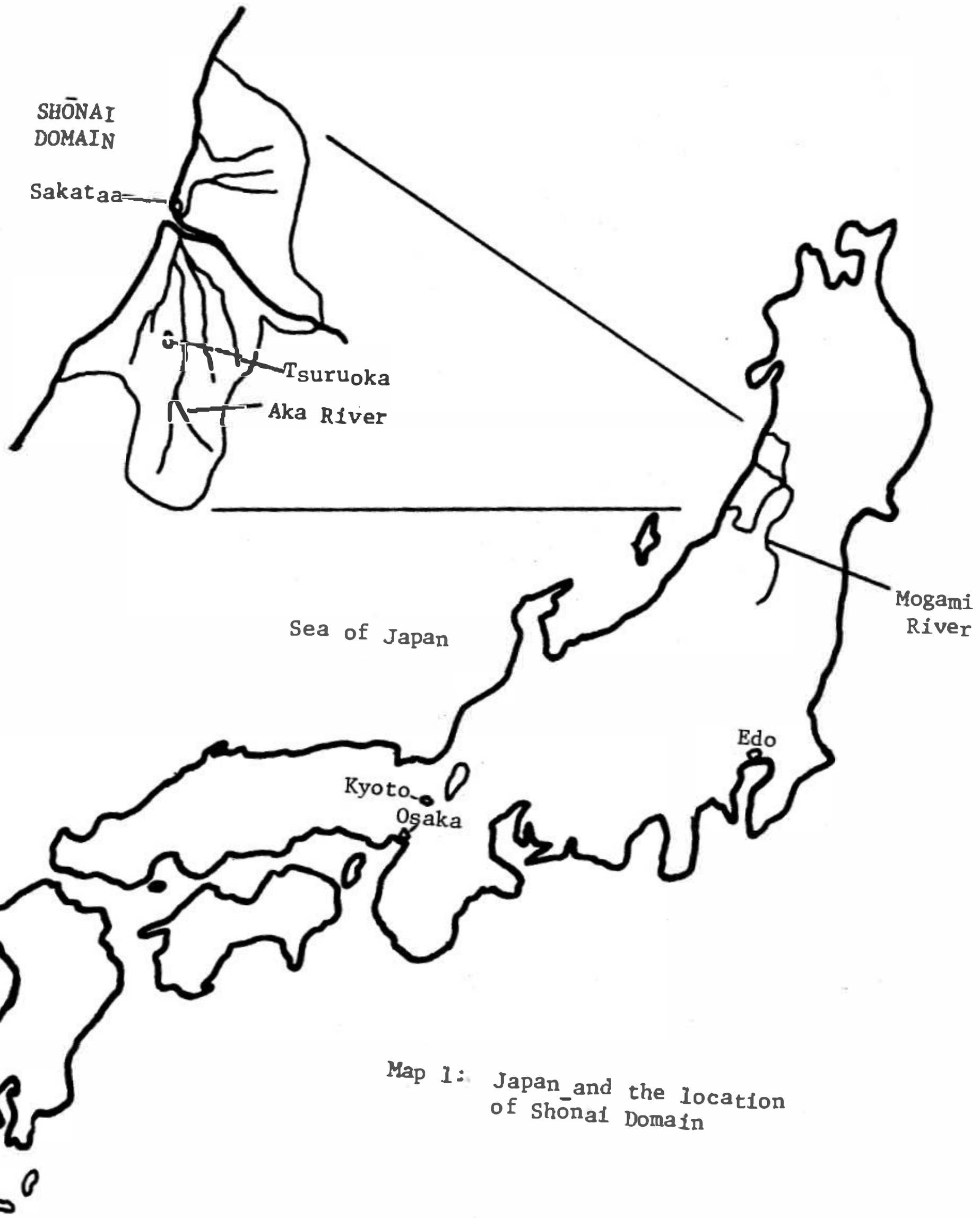
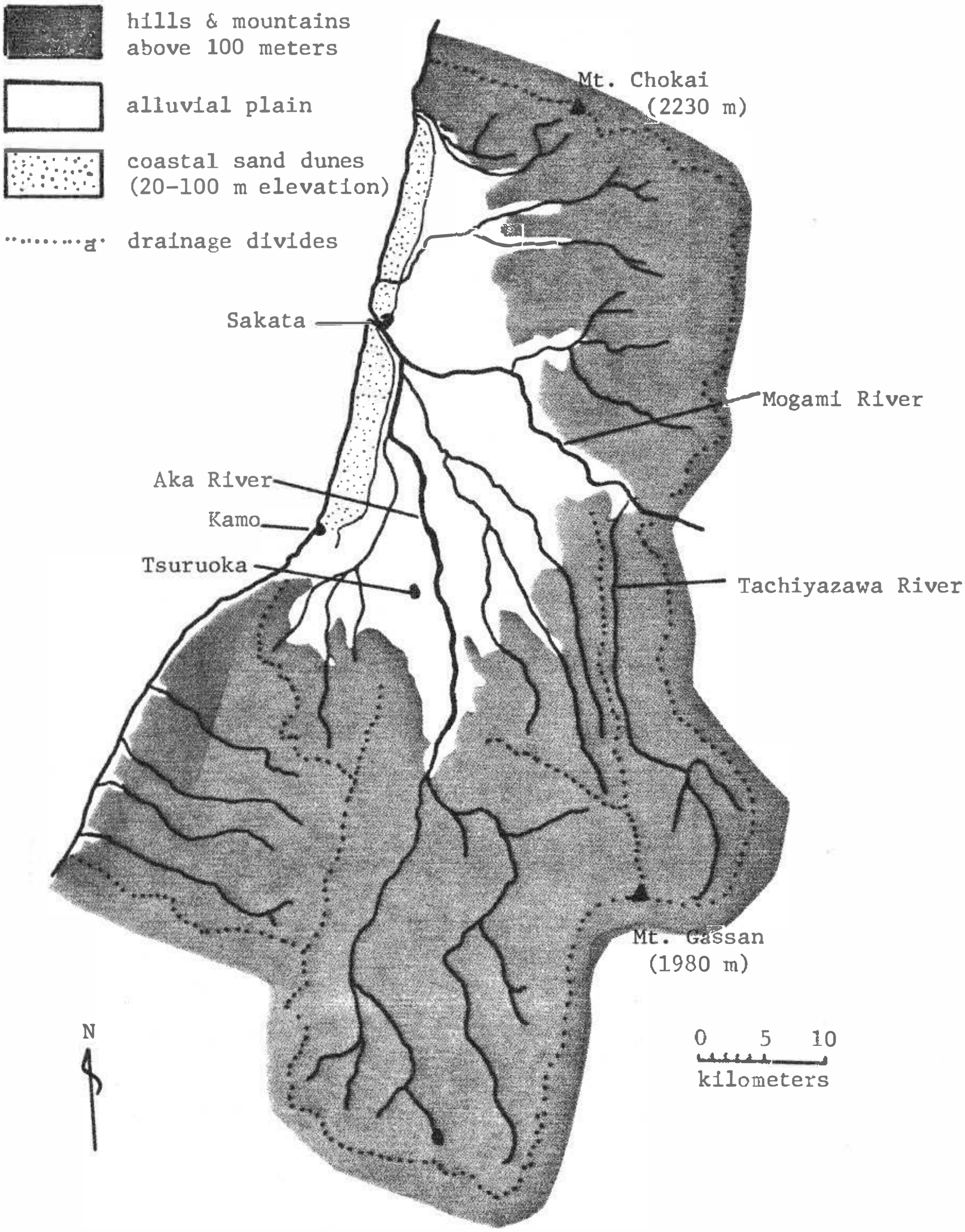
[91] See Kelly 1980:508-520 for a brief sketch of irrigation in the Meiji period, which is the subject of current research.

LIST OF MAPS

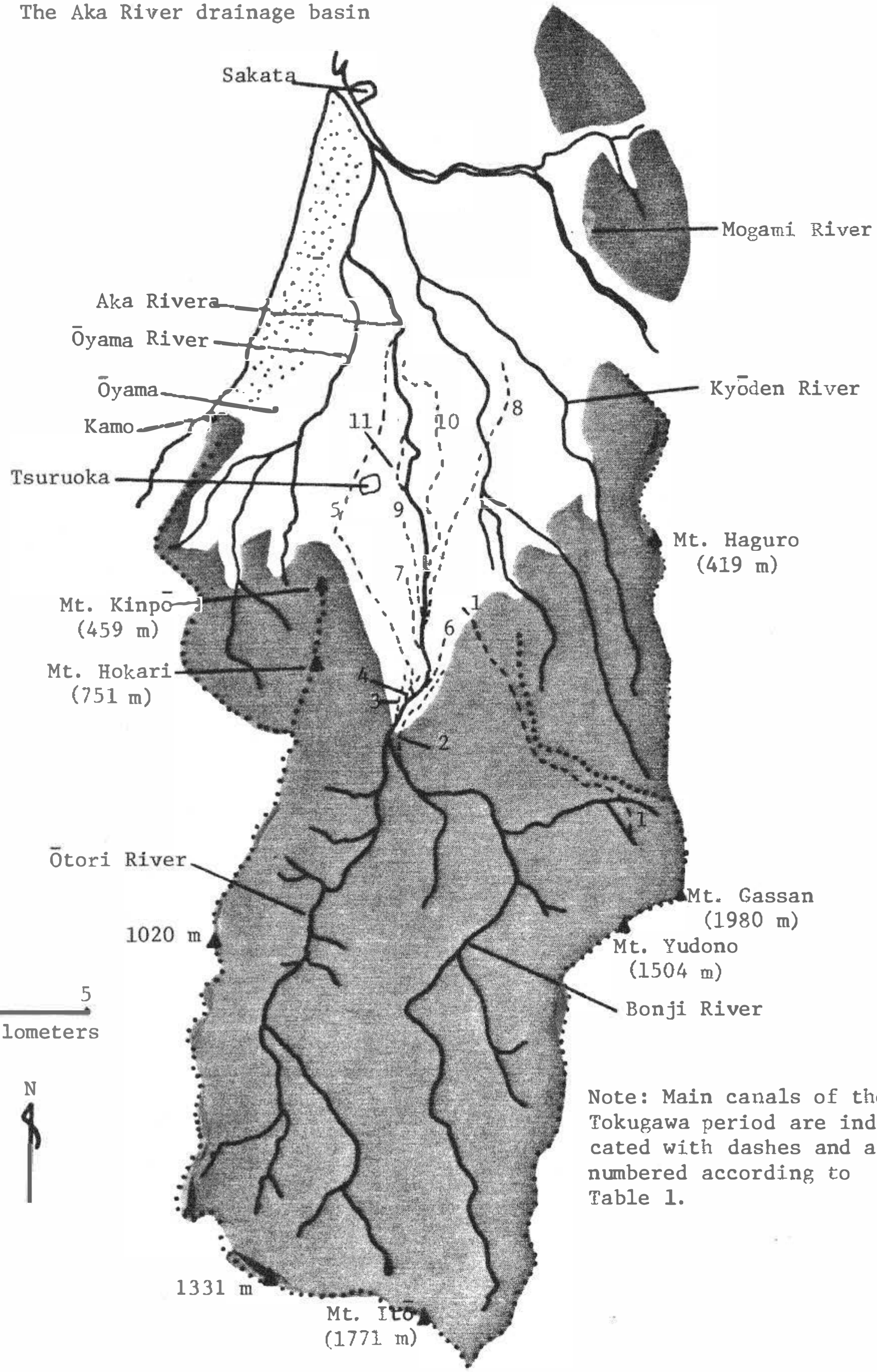


Map 1: Japan and the location of Shonai Domain

Map 2: Shōnai


hills & mountains above 100 meters
alluvial plain
coastal sand dunes (20-100 m elevation)
drainage divides
Mt. Chokai (2230 m)
Sakata
Mogami River
Aka River
Kamo
Tsuruoka
Tachiyazawa River
Mt. Gassan (1980 m)
N
0 5 10
kilometers

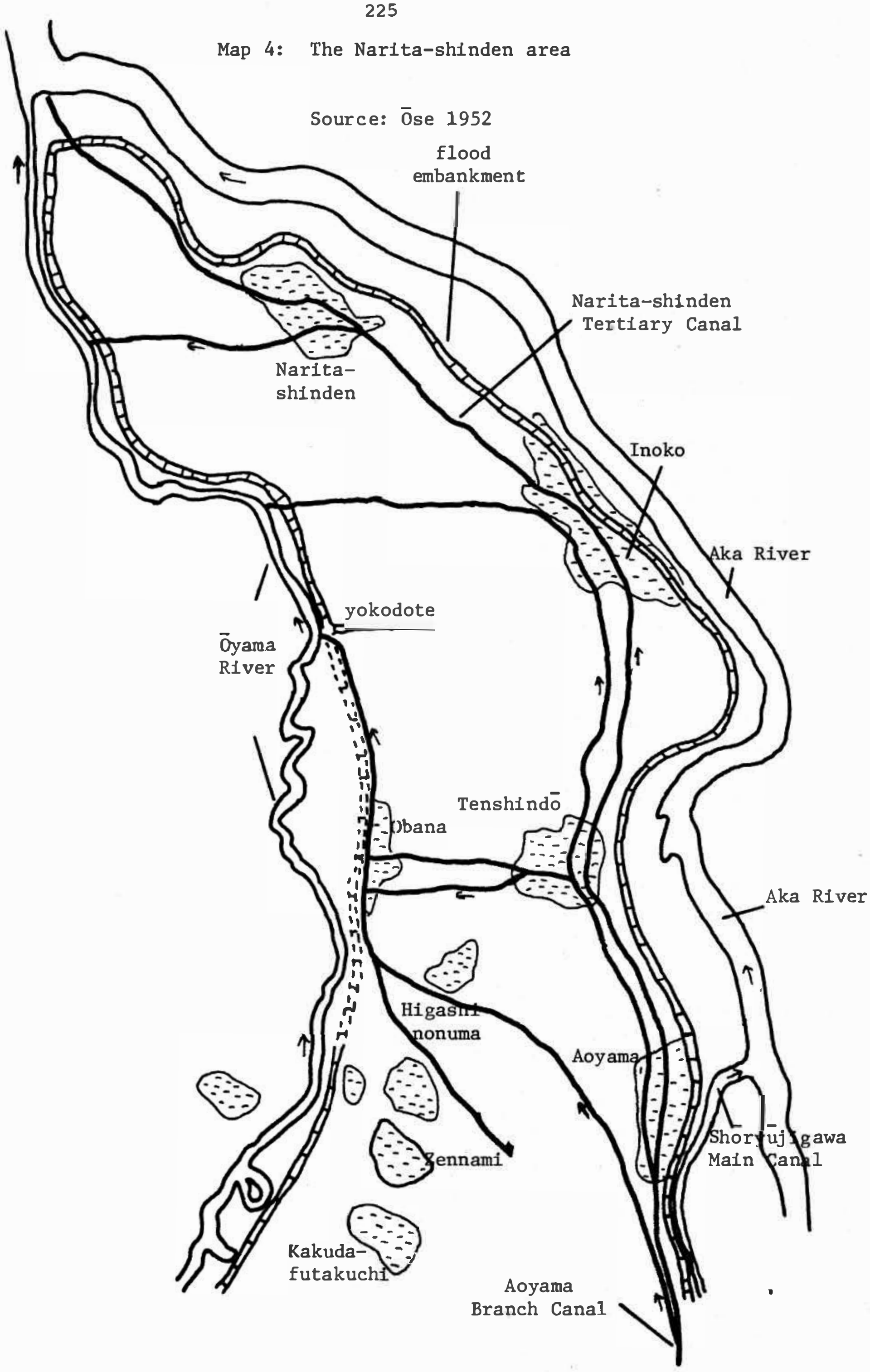
Map 3: The Aka River drainage basin



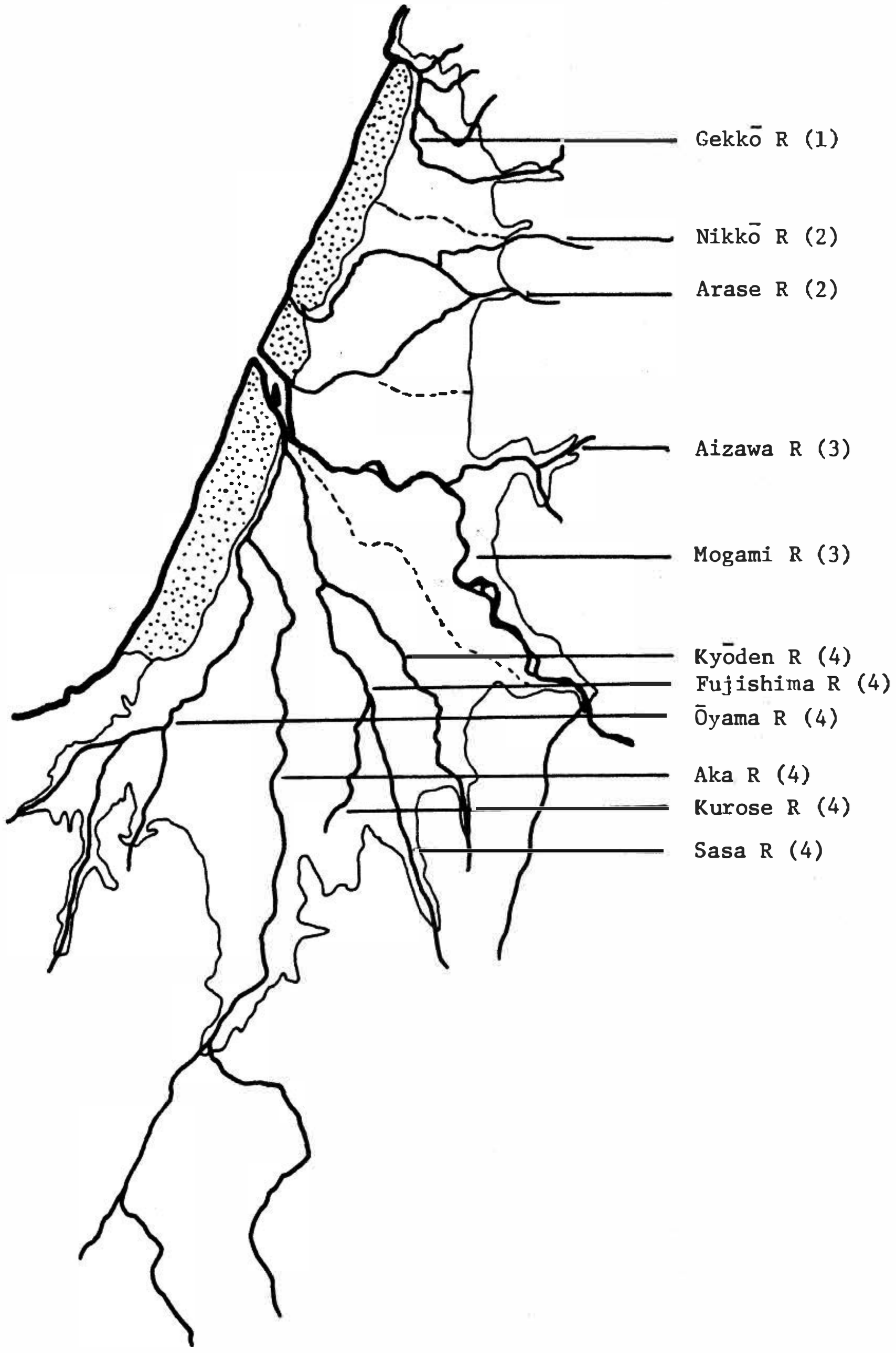
Note: Main canals of the Tokugawa period are indicated with dashes and are numbered according to Table 1.

Map 4: The Narita-shinden area

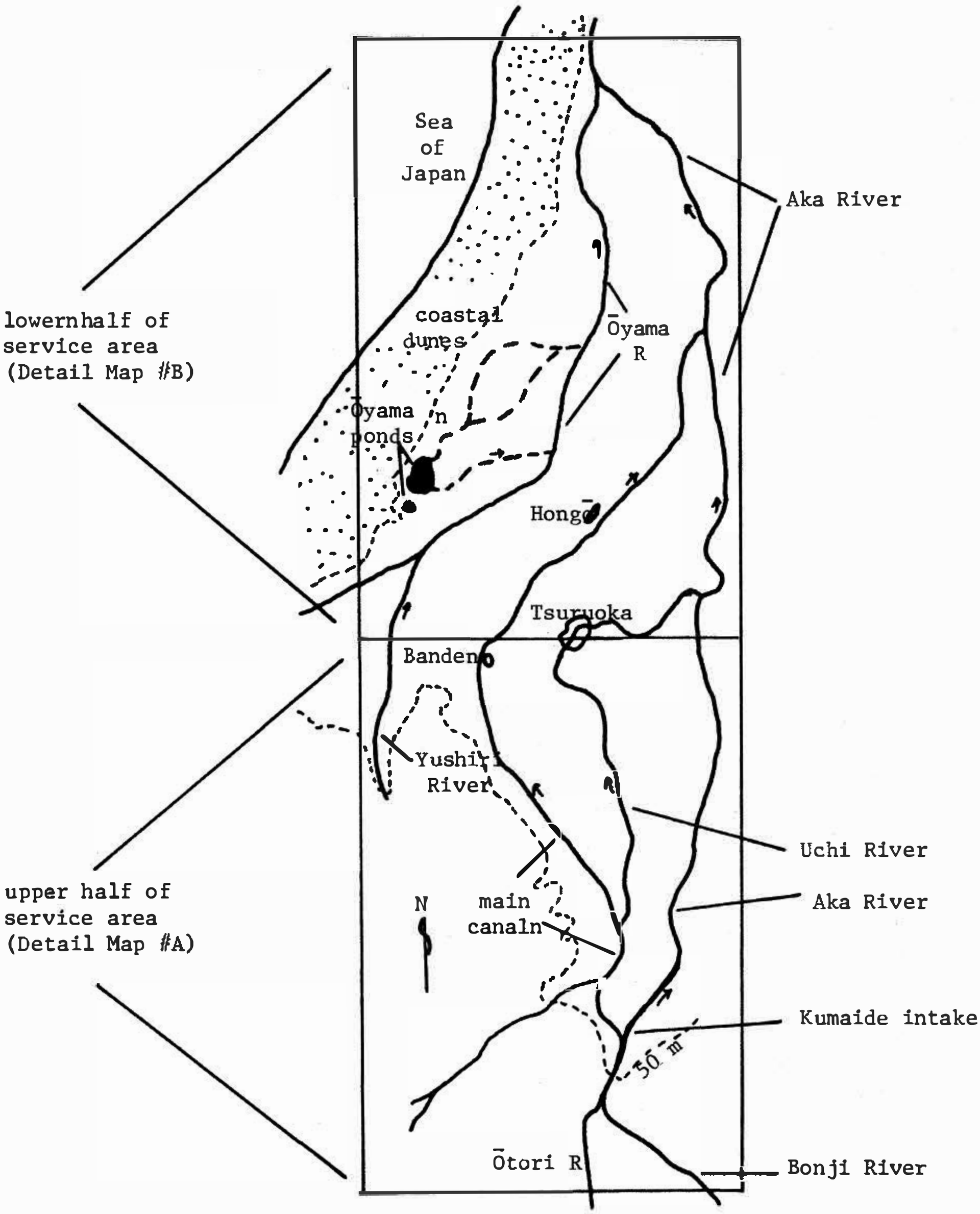
Source: Ōse 1952



Map 5: River systems of Shōnai Plain

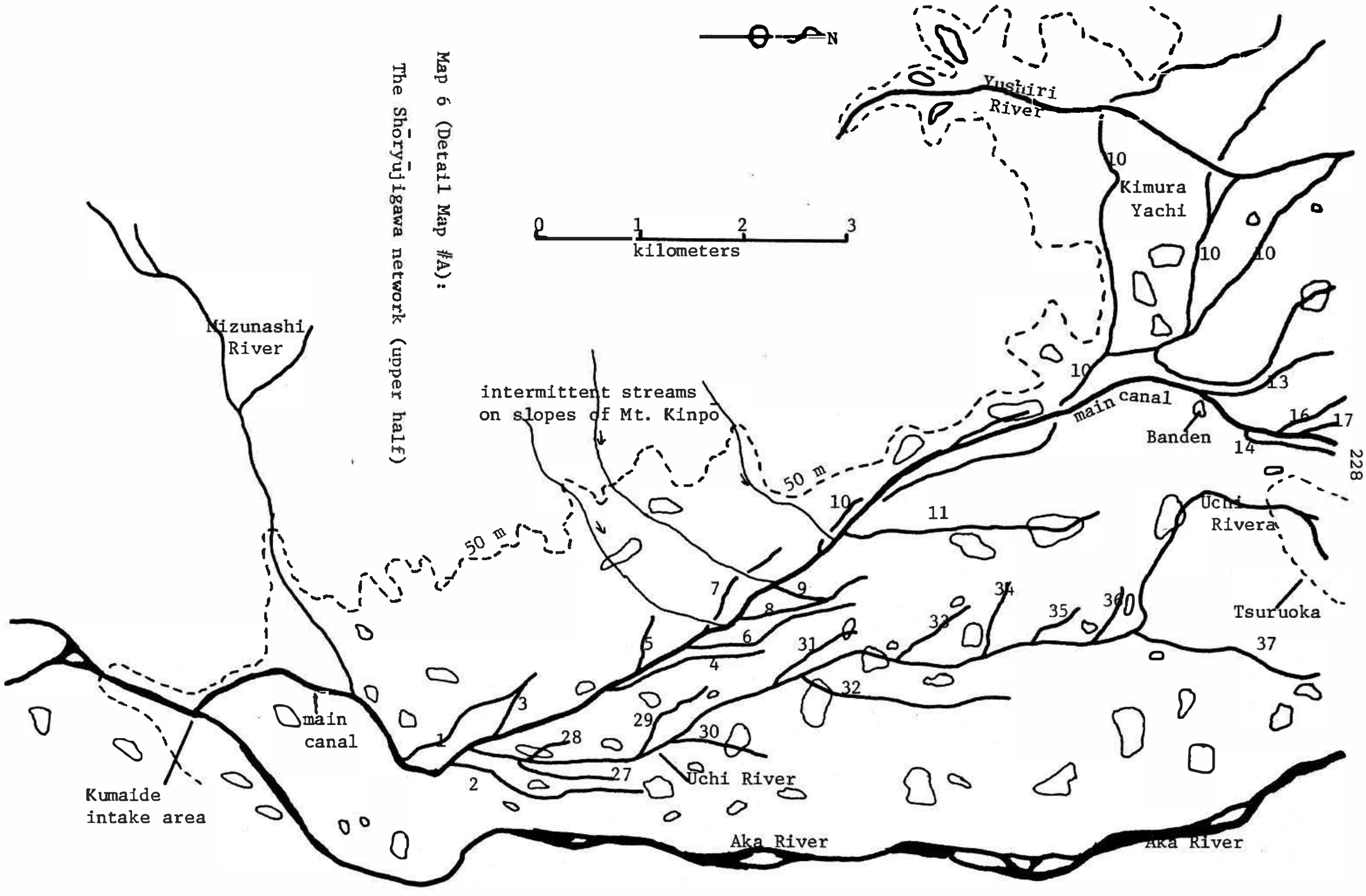


Map 6: The Shōryūjigawa network



Map 6 (Detail Map #A):

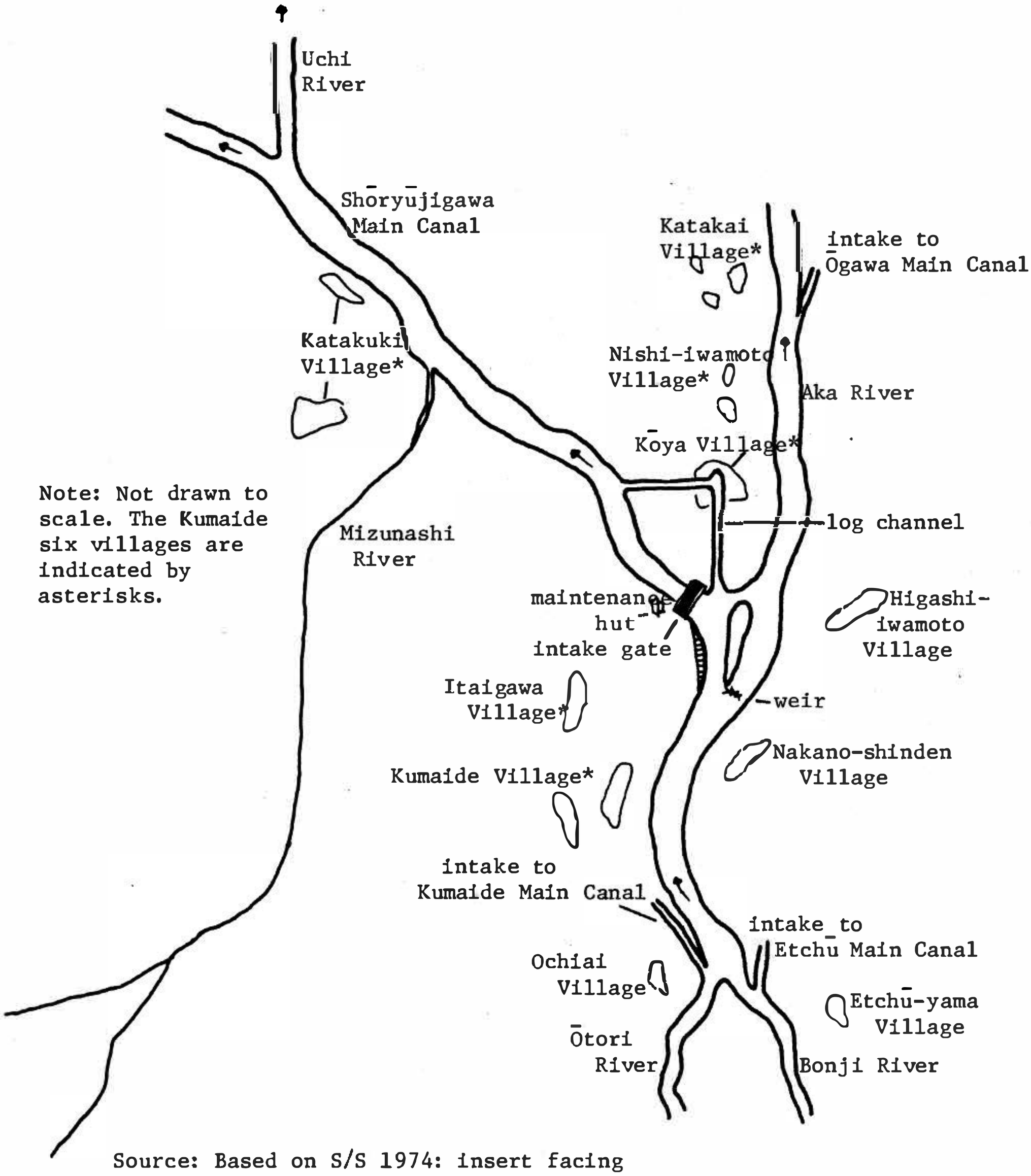
The Shōryūjigawa network (upper half)



Map 6 (Detail Map #B): The Shōryūjigawa network (lower half)

Ōyama ponds
Ōyama
pond
delivery
canals
Sea of Japan
coastal
dunes
Ōyama
River
Yushiri River
10
a
N
50 meters
Yonede
Hayashizaki
13
16
17
Bara-shinden
Hirooka-
shinden
Ōyama River
Nishinonuma
18
20
Kakuda-
futakuchi
main canal
21
Harima
Tsuruoka
Hongō
23
Narita-
shinden
14
19
24
Naka-
kyōden
25
Uchi
River
22
Aoyama
26
Inuko
Aka River
37
main canal
Aka River
0 1 2 3
kilometers

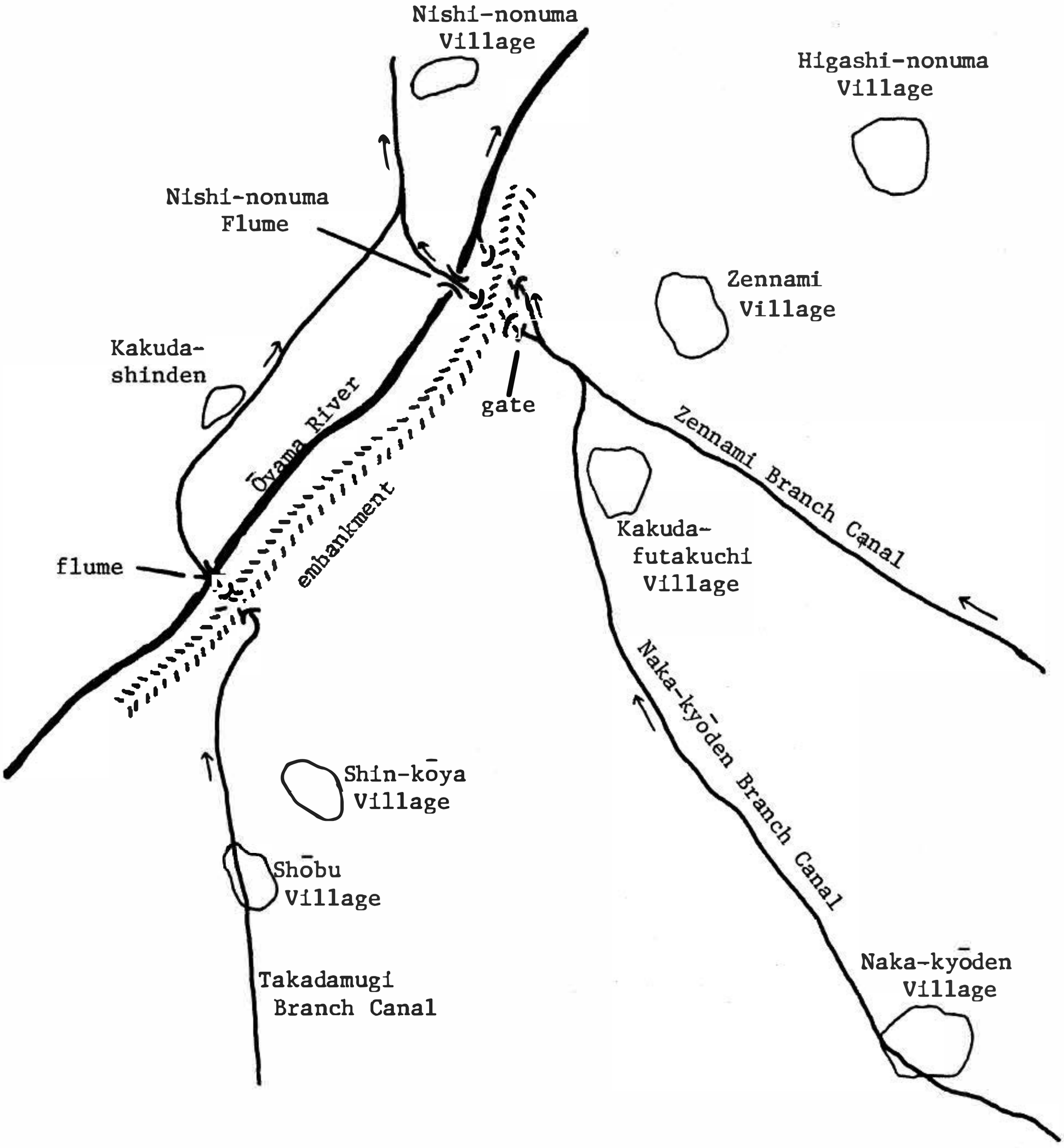
Map 7: The Kumaide six village area



Note: Not drawn to scale. The Kumaide six villages are indicated by asterisks.

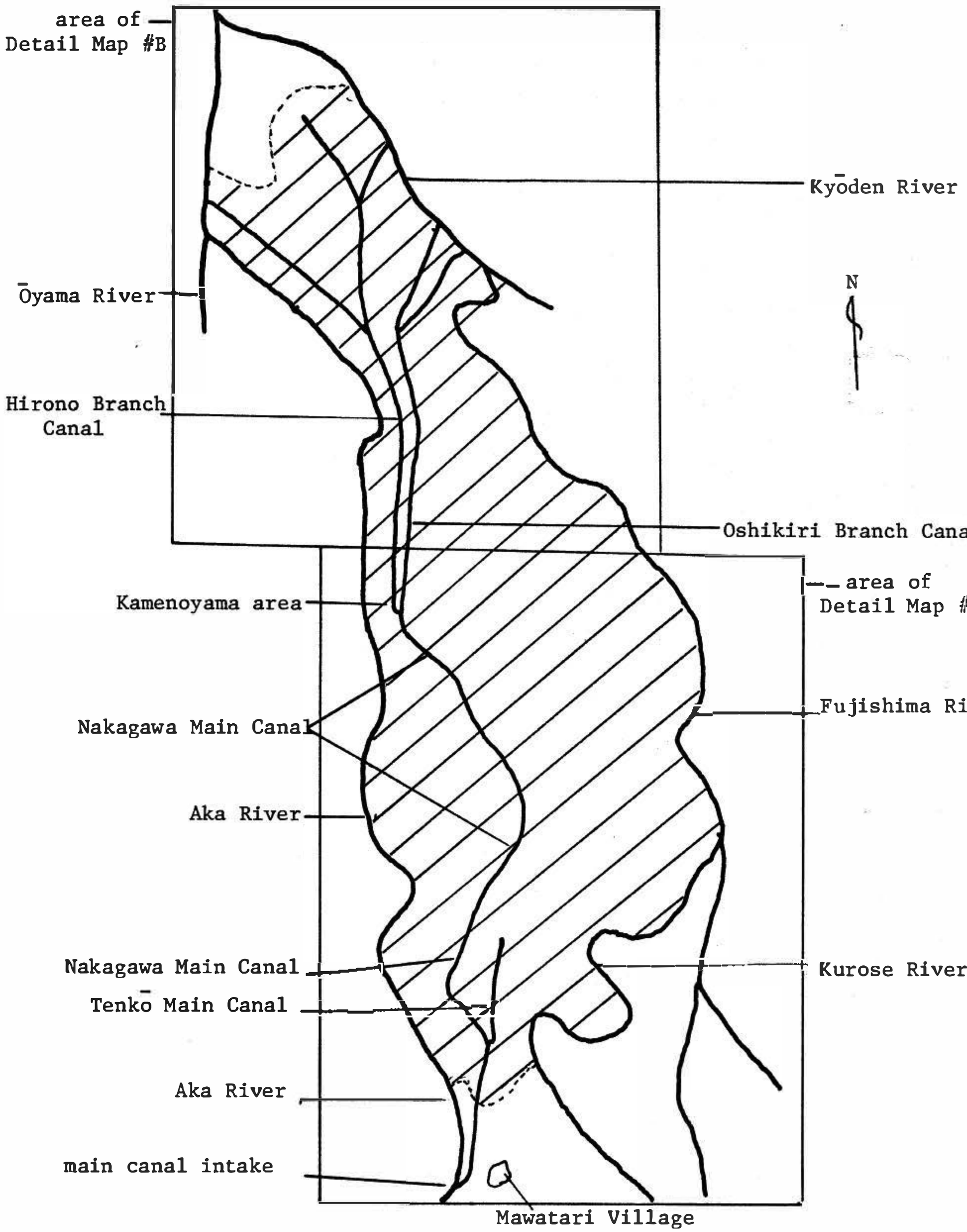
Source: Based on S/S 1974: insert facing page 272; Tsuruoka City n.d.

Map 8; Sketch map of the Kakuda-futakuchi area



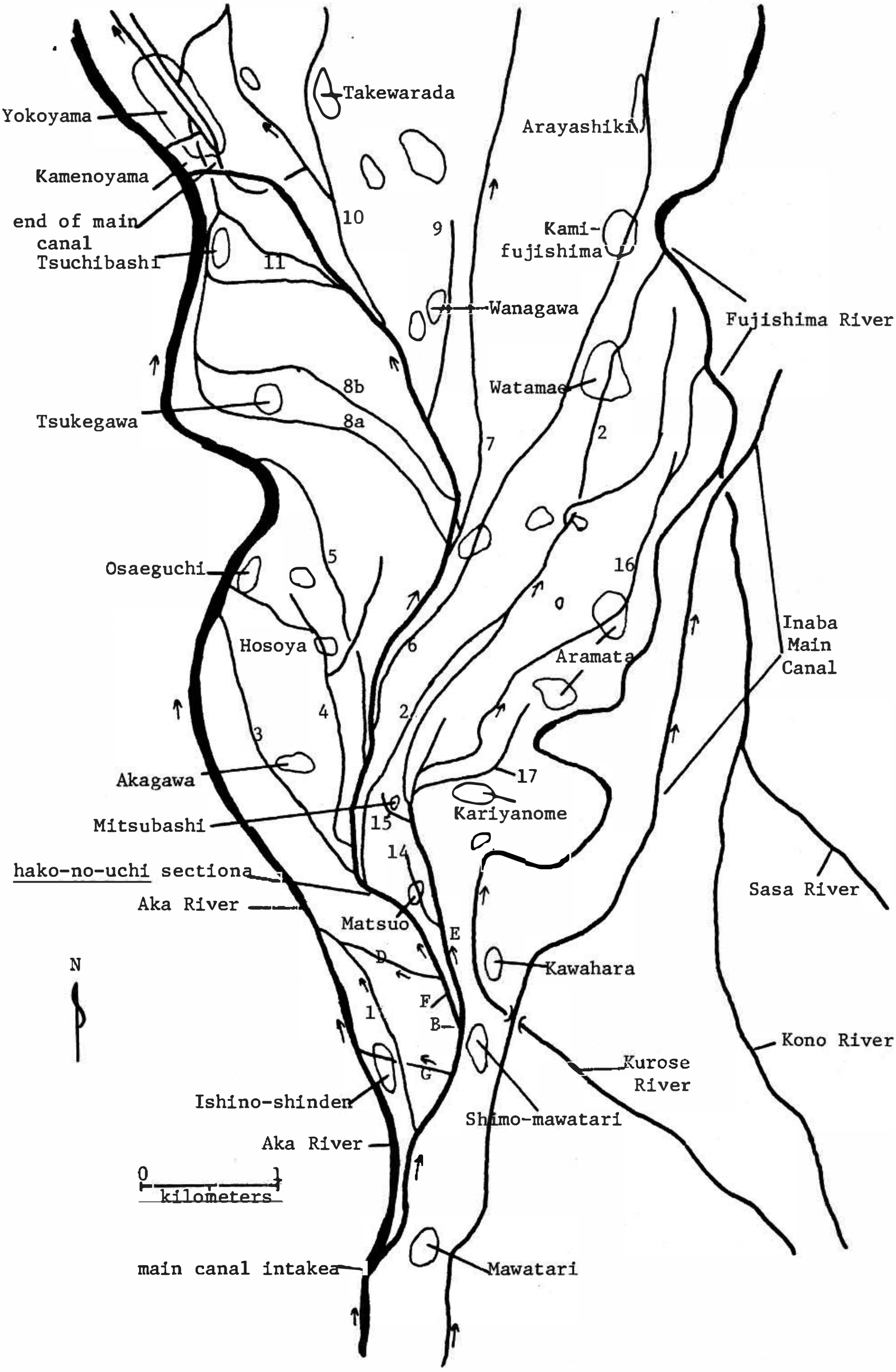
Note: No domain period maps of this area have been located, and thus this is a sketch based on the various documents discussed in the text.

Map 9: The Nakagawa network



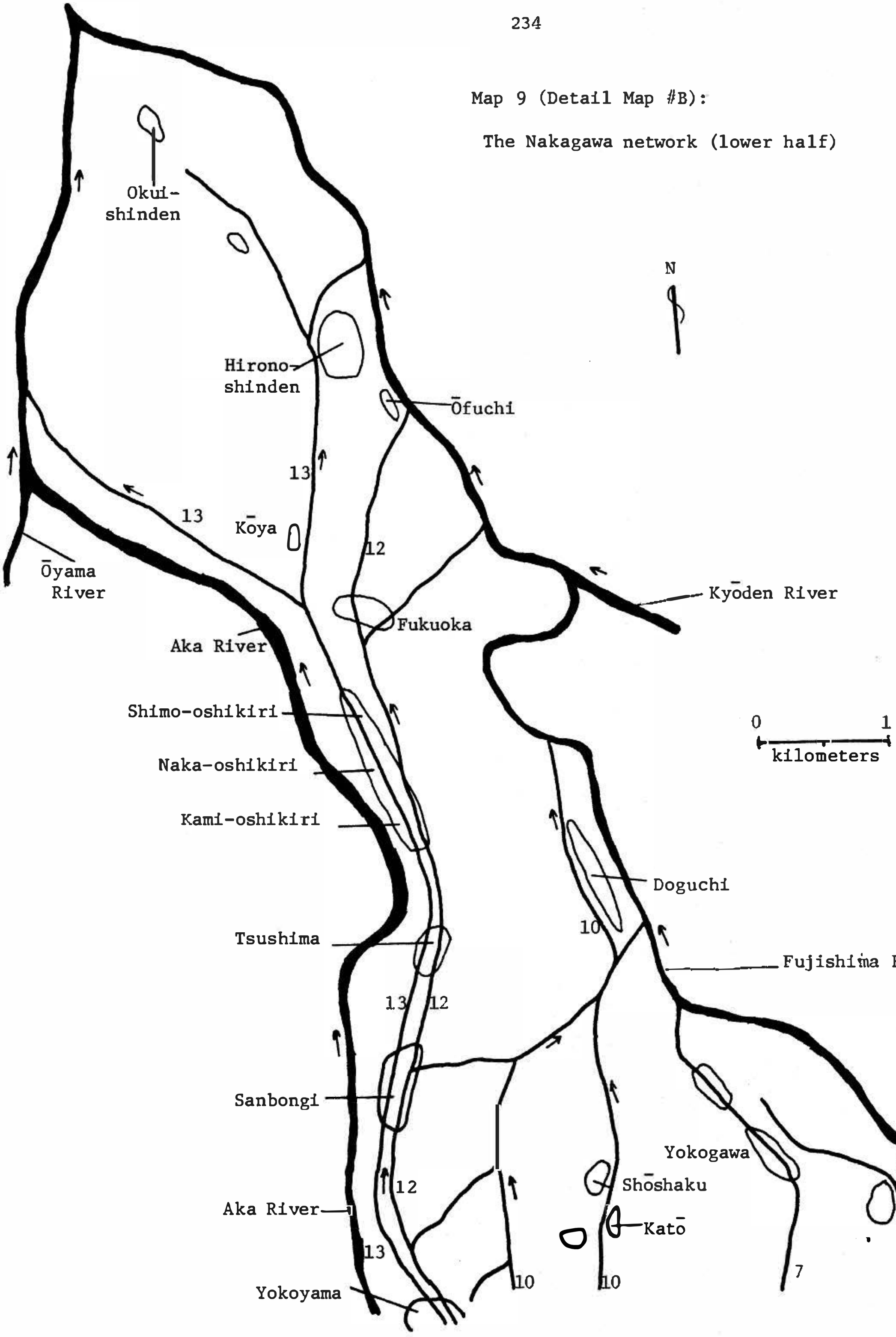
approximate main canal service area boundaries

Map 9 (Detail Map #A): The Nakagawa network (upper half)

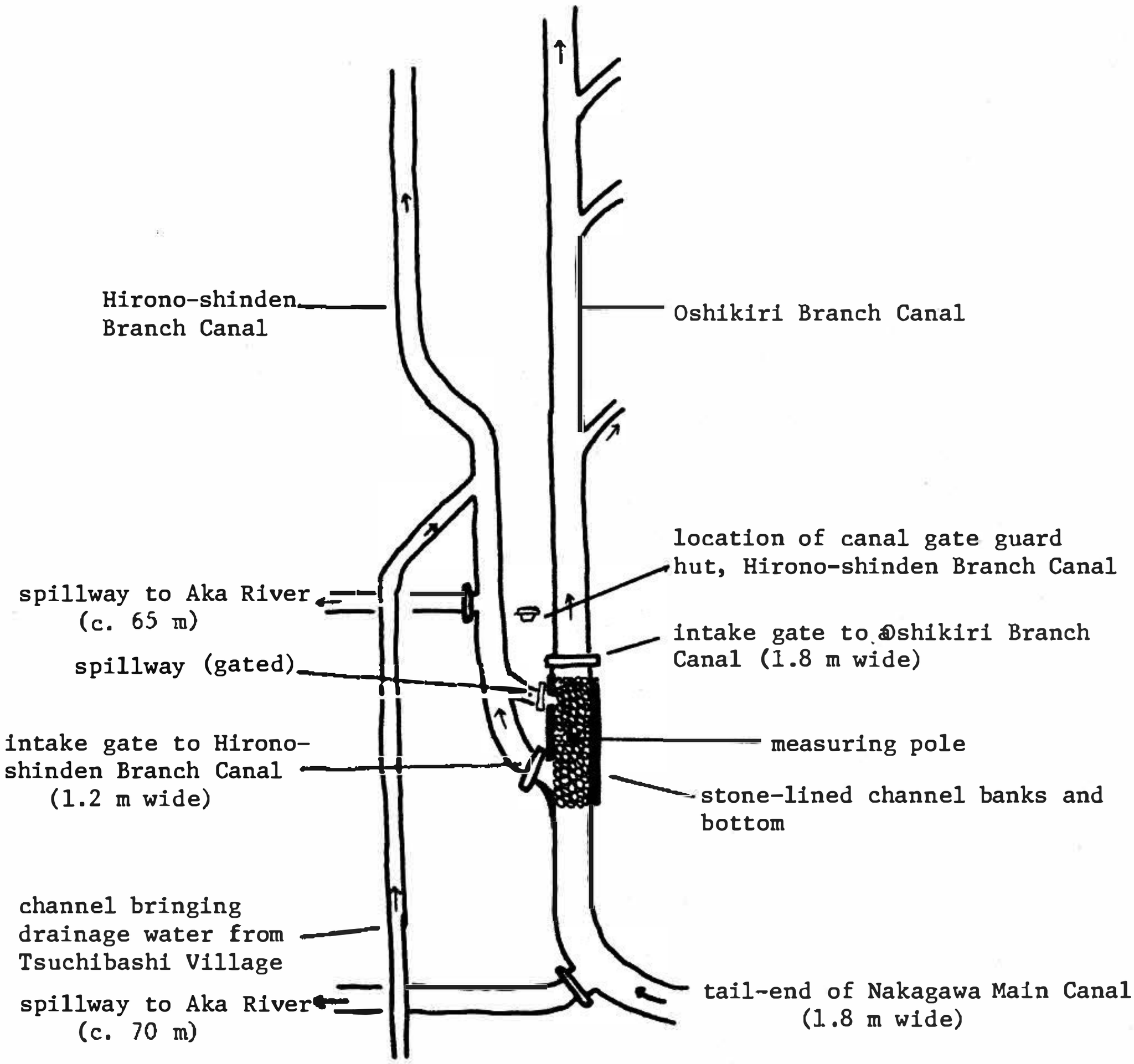


Map 9 (Detail Map #B):

The Nakagawa network (lower half)

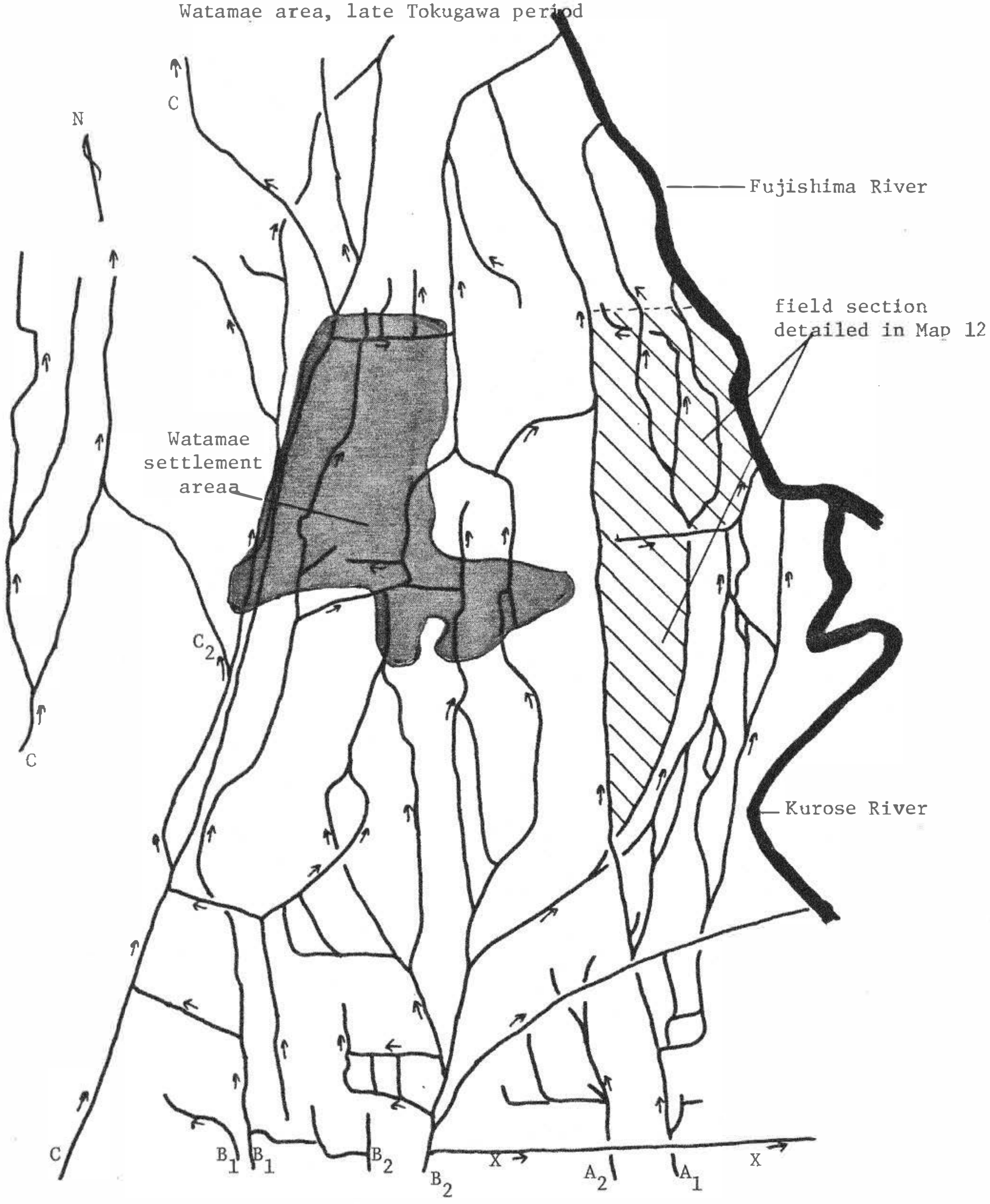


Map 10: Kamenoyama and the intakes of Hirono-shinden and Oshikiri Branch Canals



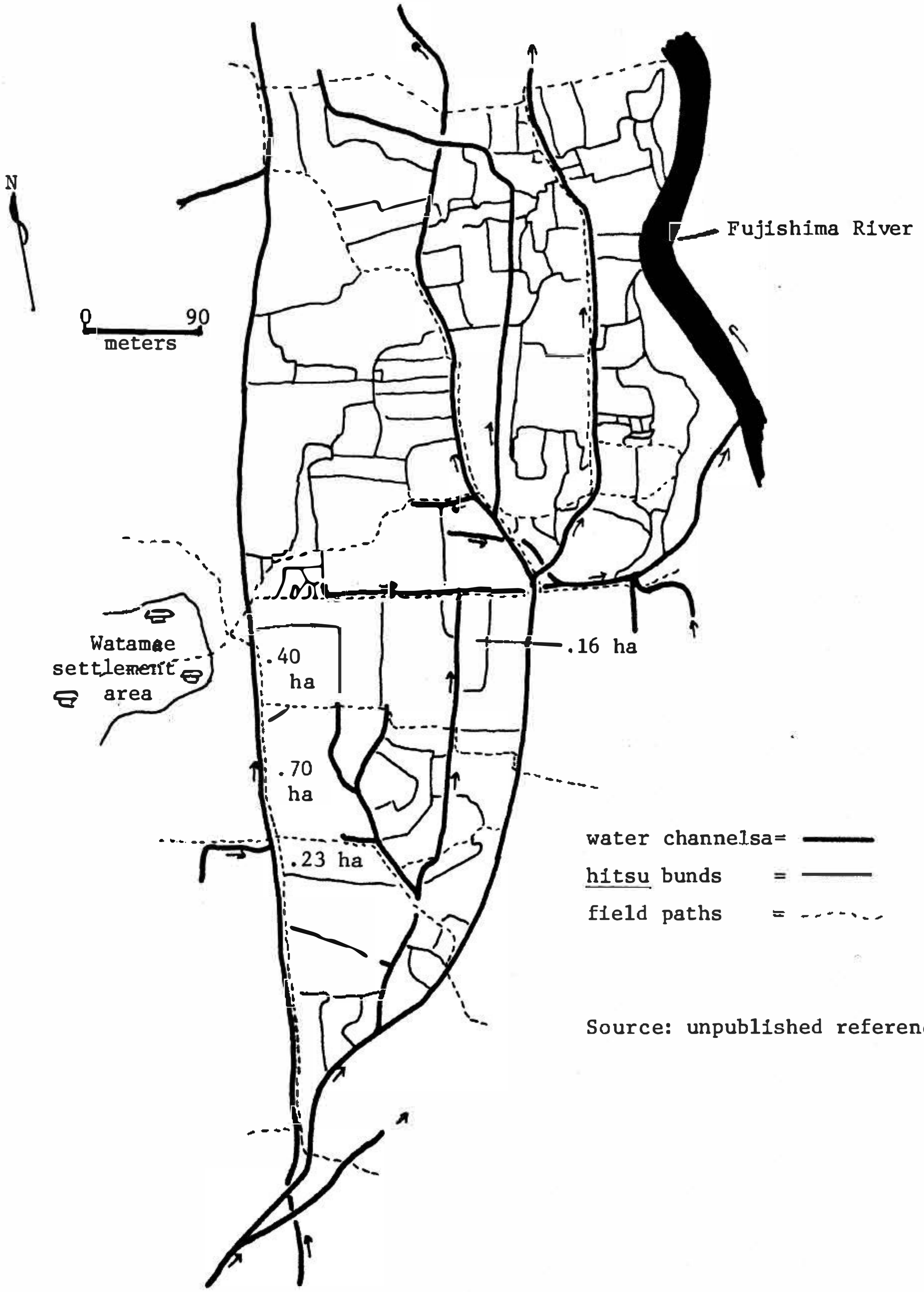
Source: Based on unpublished reference #1

Map 11: A schematic map of the water channel pattern in the Watamae area, late Tokugawa period



Note: A_1,A_2: tertiaries of Aramata Branch Canal
B_1,B_2: tertiaries of Watamae Shinden Branch Canal
C_1,C_2,C_3: tertiaries of Gokamura Branch Canal

Map 12: Field and ditch layout in a section of Watamae, late Tokugawa period



Source: unpublished reference #5

GLOSSARY

Abe Tokusaburō 阿部得三郎
age-kuchi 揚げ口
agemai 上げ米
Aka-gawa 赤川
Akino 秋野
akusui 悪水
aodachi 青立
arakoshi 荒起
ara-shirokaki 荒代掻
ashimai 足米

bangashira 番頭
bansui 番水
beisatsu 米札
Bonji-gawa 梵字川
bugari chō 歩刈帳
bunmai 分米
bunsuijō 分水場
bunsui-kuchi 分水口

chōja banzuke 長者番付
chōnin ukeoi-sei 町人請負制
chōsei 調整
chūkō 中耕
chūte 中稍

daikan 代官
daikenkin 大献金
dekimokuroku 出目金録
demi 出目
demizu 出水
dogō 土豪
doyōboshi 土用干し

Edo masu 江戸枡

Fude no Amari 筆濃餘理
fujimai 扶持米
Fujishima-gawa 藤島川

gen'ya 原野
gō 郷
gogō-suri genmai 五合摺玄米
goto iri 五斗入
gofushin 御普請
gōfushin 郷普請
gofushin tokoro 御普請所
gō-gofushin narabi gōkata jinma-wari sadame-kaki 郷御普請並郷方人馬割定書

gokachū 御家中
gōshi 郷士
goshihō 御仕法
gun 郡
gun-bugyō 郡奉行
gundai 郡代
gunyaku 軍役

hako-no-uchi 箱内
harai masu 払桝
haru makura 春枕
hasshaku-ki 八尺木
hatake-kaeshi 畑返
haya-age 早揚
heisui 平水
hikae 扣
hikae-tei 空堤
himori 樋守
hitsu 筆
honden fushin 本田普請
Honma Mitsuoka 本間光丘
honmononari 本物成
hontō nengu 本途年貢
hontō torika 本途取箇
hyōta-watari 俵田渡

ichi-no-kuchi 一口
ineage 稲上げ
iriai-ken 入会権
irihi 圦通
itaya kaede 槭 and 板屋楓

jigata chigyō 地方知行
jimoto ninsoku 地元人足
jōkoku 上穀
jōmen-sei 定免制 and 請免制
jōmen-tori 定免取
josō 除草
jōsui 常水
josui 除水

kajō keisū 河状係数
kakehi 掛樋
Kamo 加茂
kanemoto 金元
kanitsume 蟹爪
kanten 罫天
kara mi 唐箕
kara usu 唐臼
karidaka 刈高
karishiki 刈敷
karisoku 刈束
karō 家老

Katō Tadahirō 加藤忠広

kawagata 川形

kenchi chō 検地帳

kenmi-sei 検見制 and 毛見制

kenmi-tori 検見取

kenpakusho 建白書

kimoiri 肝煎

kirimai 切米

kirizoe 切添

kishiba shoharaiyaku
木柴諸払役

kishikakoi 岸囲い

kobanmai 小番米

kōjōsho-oboe 口上書覚

kōki 耕起

kokiri 小切り

kokudaka 石高

kome tōshi 米籠

komononari 小物成

kōri 郡

Kōsai-roku 弘栄録

kosaku-ryō 小作料

kosekimori 小堰守

kotekiri 小手切

kotsuetsuki 小杖突

kowari 小割

koyashi hakobi 肥薗運び

kōzui 洪水

kuchimai 口米

Kudō Kageyuzaemon 工藤甚解由左衛門

Kudō Kamon 工藤掃部

kumi 組

kumigashira 組頭

kuramai-chigyō 蔵米知行

kurobanashi 畔放し

kuromawashi 畔廻し

kusatori 草取

Kyōden-gawa 京田川

kyōdōtai 共同体

kyonen-chū takawari o motte bunsui aitachi sōrō
去年中高割ヲ以テ分水相立候

machi bugyō 町奉行

maguwa 馬耙

mai 枚

makura 枕

mangoku tōshi 万石籠

men 免

metagi 女太木

mido awase 水門合せ

mido kuchi 水門口

mido yabure 水門壊り

Mikamachi-gawa 三田町川

miyako masu 京桝

mizu no kakehiki 水の掛け引き

mizuban 水番

mizukake-tadaka 水掛田高

mizusage 水下げ

mizushita ninsoku 水下a人足

mochi mai 標米

Mogami Yoshiaki 最上義光

momisuri 籾摺

monoii tsukamatsuri sōrō
物言仕候

morai mizu 貰水

motogoe 基肥

motojime 元締

mura-age chi 村上げ地

muradaka 村高

murakata 村方

naedoko koshirae 苗床拵え

nagae kama 長柄鎌

naidaka 内高

naisai toriatsukai 内済取扱

naka-shirokaki 中代掻

nakakuro 中畔

Nakagawa ōseki Tenkō seki
中川大堰天高堰

natsu makura 夏枕

nauke hyakushō 名請百姓

negoe 根肥

nengu waribiki 年貢割引

nengurwari motokime chō
年貢割元極帳

niban ue 二番植

Niizeki Inaba-no-kami Kushō
新関因幡守久正

nodachi 野太刀

nushi tsuke 主付 and 主附

Ōgawa 大川

oigoe 追肥

ōjoya 大庄屋

okute 晩米

okyūnin 御給人

ōmetsuke 大目付

omizuchō 御水帳

omote kokudaka 表石高

omotojime-kaku 御元締格

onmakai 御賄

osa 畝

osame masu 納桝

ōsekimori 大堰守

oshi yasume 押休

otadashi ni tsuite moshiage sōrō
御礼ニ付申上候

otono 長人 (but more usually, 2 名)

otonabyakushō 長百姓

Ōtori-gawa 大鳥川

otoshi 落し

ōtsuetsuki 大杖突

ōwariai no bunsui 大割合ノ分水

Ōyama 大山

rokushichi sao 六七竿

rōnō 老農

sadame hō 定法

sadame ki 定杭

sadame mai 定米

saido 砕工

saikaku kin 才覚金

Sakai Tadatoki 酒井忠解

Sakai Tadakatsu 酒井忠勝

Sakai Tadatsune 酒井忠恒

Sakai Tadayori 酒井忠寄

Sakata 酒田

sakutoku mai 作得米

san-ka-ichi mai 三ヶ一米

sashibikiritsu 差引率

sashidashi meisai chō 差出明細帳

sashigoe 刺し肥

Satō Tōzō 佐藤東蔵

satsuki 五月

seki 堰

seki-ban 堰番

sekidai 堰台

sekiguchi toritate 堰口取立

sekiko 堰子

sekine 堰根

shimarikiru 締り切る

shinden-gashira 新田頭

Shinmachi-gawa 新町川

shinsao uchinaoshi 新竿打ち直し

shirodai karō 城代家老

shirokaki 代掻

shitayaku 下役

shitsukainin 悉皆人

shitsuke mizu 仕付け水

Shōnai 庄内（荘内）

sode 袖

soeyaku 添役

sokohi 底樋

sobayōnin 側用人

suitō 水桶

sumikuchi shōmon 済口證文

su-no-ki スノキ（スノ木）

su-no-ko 簀子

sunshi ninsoku 寸志人足

sutemizu 捨水

taihi-biki 堆肥引き

takabari-ta 高張田

takaki 田掻

takanuki-ta 高抜田

takoshi kangai 田越灌漑

takoshirae 田拵え

takuro-kiri 田畔切り

tane bujiki mai 種夫食米

tauchi 田打ち

teatebiki 手当引き

tedai 手代

tōri chō gai 取帳外
(alt., tori chō hazure)

tōrikakari 通係

tōshi-mizu 通水

tsuburebyakushō 潰百姓

tsuchi usu 土臼

Tsuruoka 鶴岡

Uchi-gawa 内川

uchi sekimori 内堰守

uchiuchi 内内

ue-shirokaki 植代掻

uehi 上樋

uke-yaku 浮役

umehi 埋樋

uruchi mai 粳米

ushikura 牛倉

Wada Etchū 和田越中

wariai no bunsui 割合ノ分水

wariyaku 割役

wase 早稲

watarikuchi mai
渡口米

yabure men 破免

yachi 谷地

yamamori 山守

yashinai mizu 養い水

yokodote 横土手

yokosado 横佐土

yonto iri 四斗入

yonai mai 与内米

yōsui 用水

yōsui-gawa shihai 用水川支配

yōsui-ta tanbetsu tashō ni ōji,
kokuwari suimonhō o sadameru
用水田反別 多少に応じ刻割 水門法を
定る

zaku-seoi ざく背負

REFERENCES

ABBREVIATIONS USED IN TEXT FOR REFERENCES:

MAF: Nōrinshō [Ministry of Agriculture and Forestry]

OA: Ōse, Saitō, and Enomoto (1974)

OB: Ōse, Saitō, and Maeta (1974)

OC: Ōse, Saitō, and Satō (1975)

S/S 1966: Satō and Shimura (1966)

S/S 1974: Satō and Shimura (1974)

YKS: Yamagata-ken shi

NOTE: References are listed in three sections: unpublished references in Japanese, published references in Japanese, and published references in English. Unpublished references are listed by number in the text.

a. Unpublished References in Japanese

(1) Nakagawa ōseki bunsui ezu narabi bunsui moshitsuke sōrō ikken, Tenmei go nen Kansei gannen Bunka nenjū

[Documents Concerning Allocation Cases Along the Nakagawa Main Canal in 1785, 1789, and the Period, 1804-1818, Together With a Map of the Main Canal]

(A notebook kept by the main canal guard at Yokoyama Village consisting of copies made in 1818 of petitions and directives on complaints and conflicts about main canal affairs during the above years. Original notebook in the possession of Naganuma Gensaku, Fujishima Town.)

(2) Hirono-mura enkaku-shi

[History of Hirono Village]

(A manuscript compiled by Sugasawa Yoshitarō and Ikeda Chōgorō. Date unknown. Presently kept at Historical Materials Archives, Hirono District, Sakata City.)

(3) Yokoyama-gumi Hirono-shinden kakitsuke hikae

[Notebook of Documents Concerning Hirono-shinden Village, Yokoyama Village Group]

(A notebook compiled by the village headman in 1822 of miscellaneous documents relating to Hirono-shinden Village in the period, 1713-1822. Now kept at the Historical Materials Archives, Hirono District, Sakata City.)

(4) Otazune ni tsuite moshiage sōrō

[Reply to an Official Investigation]
(A statement signed by Oshikiri area village headmen and sent to three area village group headmen on July 25, 1857. Original in Oshikiri Village, Mikawa Town.)

(5) Watamae-mura aza chiseki ezu
[Section Land Registration Maps of Watamae Village]
(A set of maps drawn to 1:600 scale in 1894 for each aza section of Watamae Village. Presently kept at Watamae Village shrine, Fujishima Town.)

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